ENGINEERING AND MINING JOURNAL

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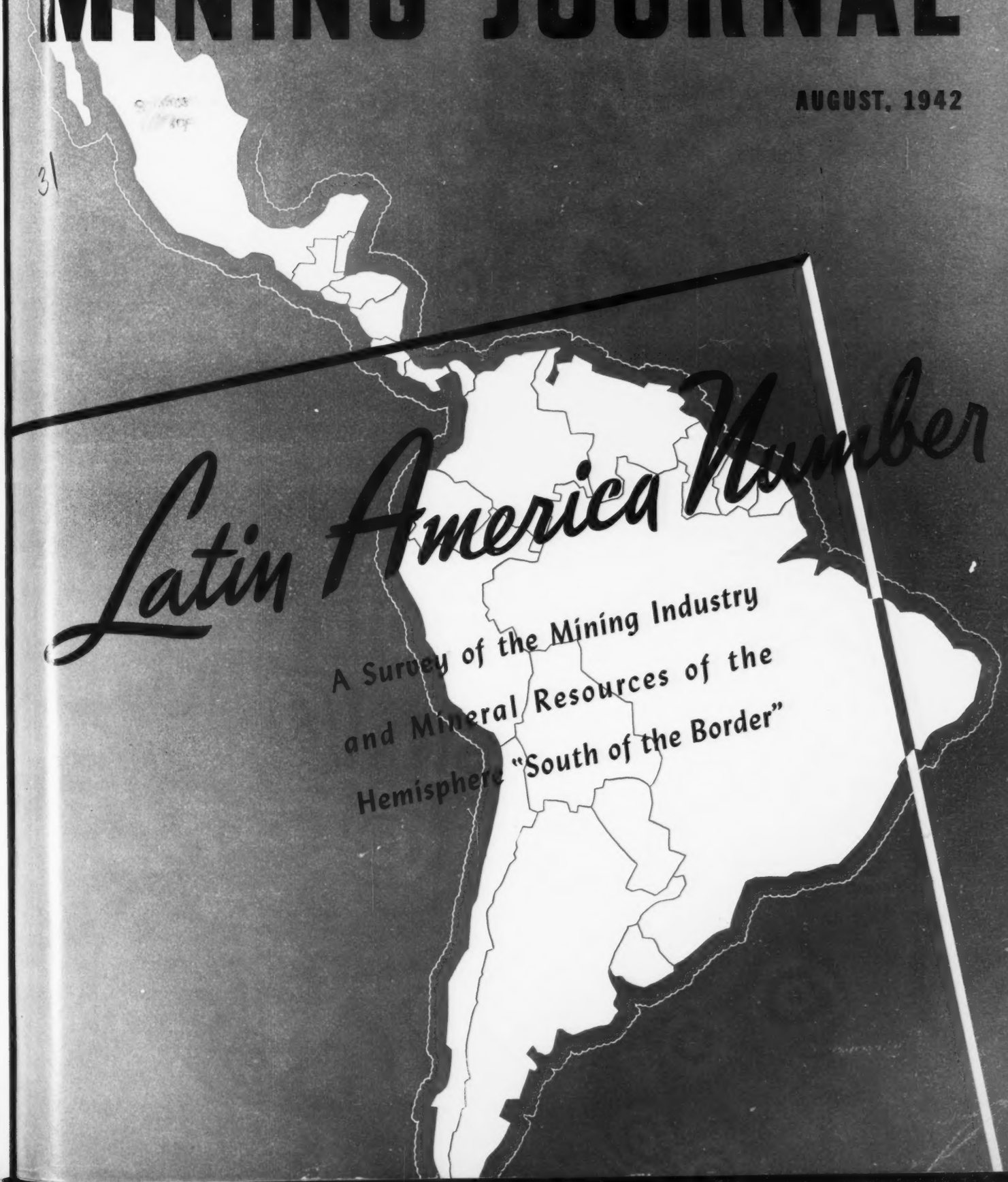
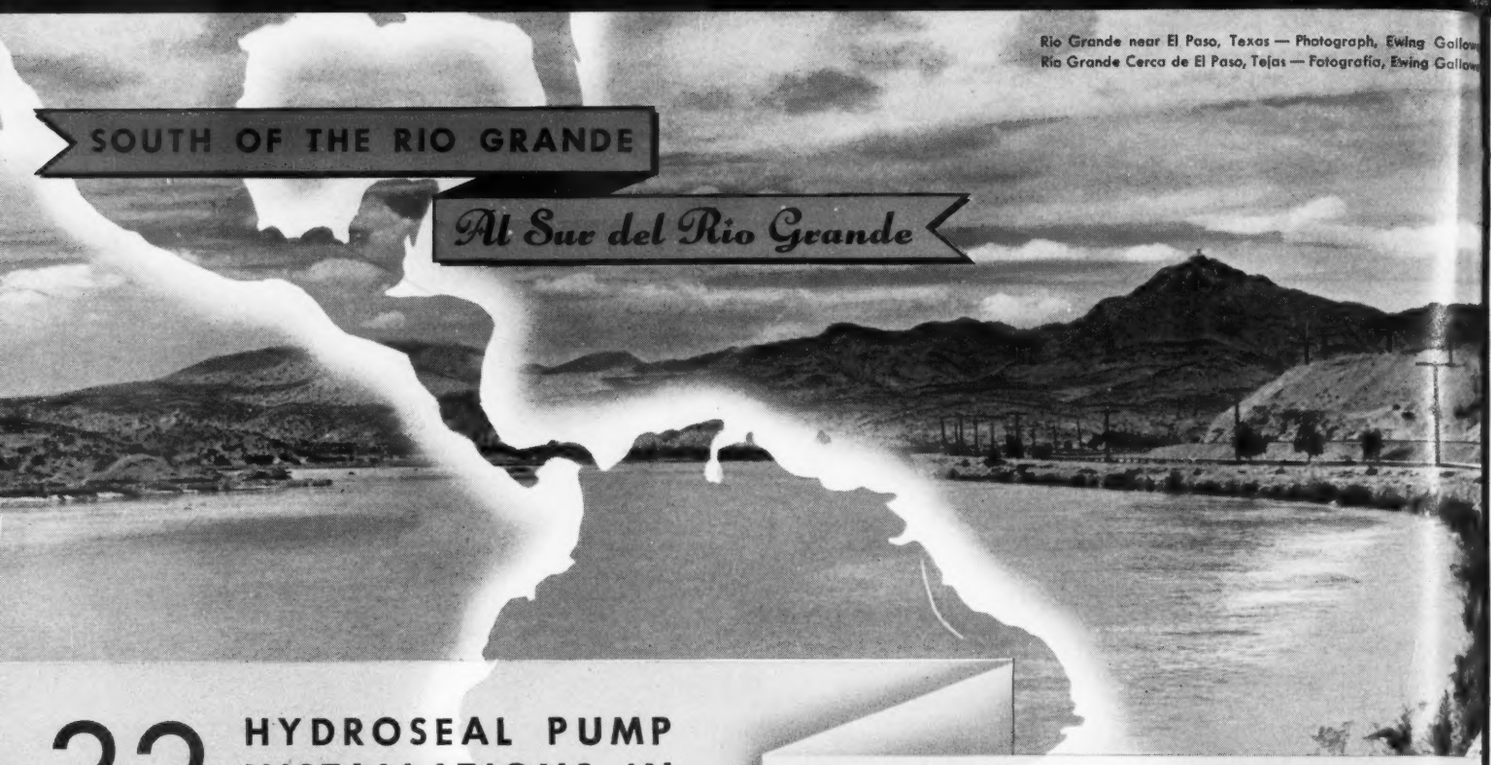


Latin America Number

A Survey of the Mining Industry and Mineral Resources of the Hemisphere "South of the Border"



Rio Grande near El Paso, Texas — Photograph, Ewing Galloway
Río Grande Cerca de El Paso, Tejas — Fotografía, Ewing Galloway

SOUTH OF THE RIO GRANDE

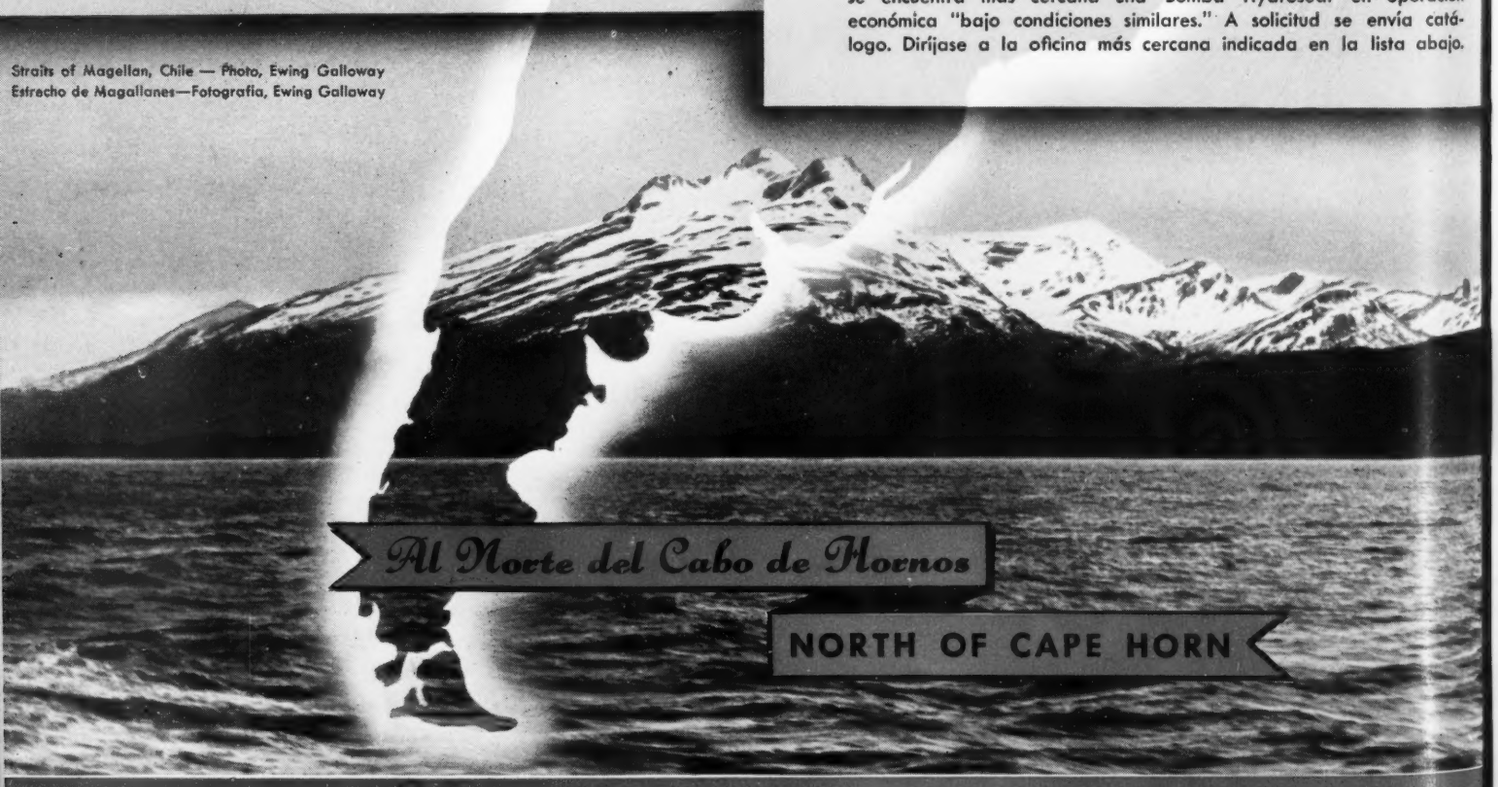
Al Sur del Río Grande

32 HYDROSEAL PUMP INSTALLATIONS IN LATIN AMERICA

We do not feel at liberty to disclose the names of the various users of Hydroseal Pumps in Latin America, thus we cannot reveal the exact number used by each mine. However, numerous repeat orders have been received. Today, Hydroseal Pumps are widely used for handling pulps, slimes and slurries, in various mill operations. If you have a tough pumping job, write us by Air Mail describing the conditions and we will reply, by Air Mail, telling you where the nearest Hydroseal Pump is operating economically "under similar conditions." Catalog sent on request. Address the nearest office listed below.

32 INSTALACIONES DE BOMBA HYDROSEAL EN AMÉRICA LATINA

No nos consideramos con la libertad de anunciar los nombres de los varios usadores de las Bombas Hydroseal en América Latina, por lo tanto no podemos revelar el número exacto que cada mina utiliza. Sin embargo, se han recibido numerosos pedidos de repetición. Hoy día, las Bombas Hydroseal se emplean extensamente para manejar las pulpas, los líquidos viscosos y mineralizados, en varias operaciones fabriles. Si Ud. tiene un trabajo de bomba difícil, escríbanos por Correo Aéreo, describiéndonos las condiciones, y le contestaremos por Correo Aéreo, diciéndole donde se encuentra más cercana una Bomba Hydroseal en operación económica "bajo condiciones similares." A solicitud se envía catálogo. Diríjase a la oficina más cercana indicada en la lista abajo.



Straits of Magellan, Chile — Photo, Ewing Galloway
Estrecho de Magallanes—Fotografía, Ewing Galloway

Al Norte del Cabo de Hornos

NORTH OF CAPE HORN

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ENGINEERING AND MINING JOURNAL

H. W. CLARKE, Vice-President

Published by McGraw-Hill Publishing Co., Inc.

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Vol. 143, No. 8

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A MINERAL MAP OF LATIN AMERICA, showing the principal mineral resources of countries south of the Mexican Border, is published as a supplement to this issue

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Publication Office: 99-129 N. Broadway, Albany, N. Y.
Editorial and Executive Offices: 330 W. 42d Street, New York, N. Y.
Cable Address: McGraw-Hill, New York

Branch Offices: San Francisco, 68 Post St.; Chicago, 520 N. Michigan Ave.; Los Angeles, Calif., 601 Fifth St.; Washington, D. C., National Press Building

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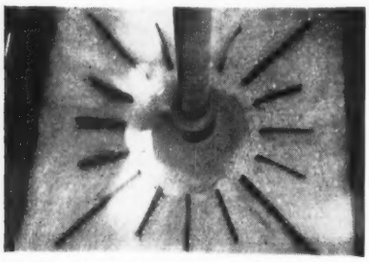
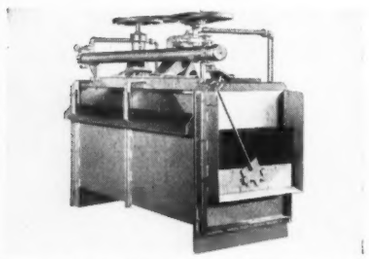
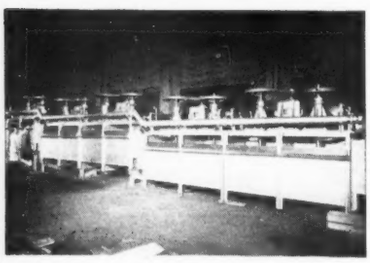


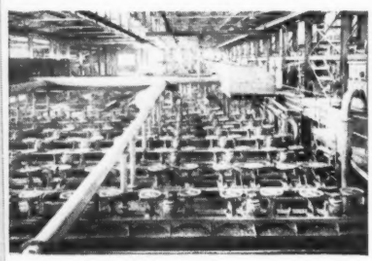
Looking down into the cell. Impeller and bubble peeler in operation.



Two cell unit of the Agitair, showing sand bleeder and tailing discharge.



Ten cell unit of No. 48 Agitair. The Agitair is built in several standard sizes to meet your requirements.



Agitair installation—Northern Rhodesia, South Africa.

The Agitair Flotation Machine

The Agitair is of the mechanical-air type, providing for adequate aeration through the medium of countless small bubbles, highly disseminated throughout the pulp, employing intense agitation at the cell bottom, and having rapid circulation of pulp, insuring large capacity per unit of volume.

The Agitair clearly leads the field for its improved metallurgical results, its lower power consumption, its smooth operation and even agitation, its low maintenance costs and freedom from shutdown.

Construction and Operation — The impeller of the Agitair consists of a cone, rigidly fastened to the bottom of a rotating shaft, and having fingers extending downwards. Air is disseminated through the pulp exposed, underneath and from between the fingers, as small bubbles.

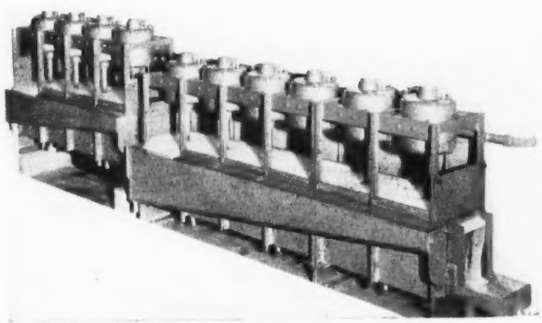
The special alloy Bubble Peeler is an aid to intense agitation and aeration, and eliminates adverse disturbances in the froth column. Due to its design, the Bubble Peeler aids in elimination of dead spots and pockets at the cell bottom and positively prevents sand or graular material from banking or accumulating.

Regulation—The Agitair offers 3-point regulation (1) a tailing overflow weir for regulating all cells or different sections to a common pulp depth; (2) froth overflow weirs on each cell; (3) air valves on every cell.

Power Consumption — The Agitair consumes from 20% to 30% less power than other machines. Plant figures vary from 0.67 to 1.92 k.w.h. per ton of ore treated, depending upon ore.

Maintenance — The Agitair has fewer functional parts, with all wearing parts quickly and inexpensively changed. The Bubble Peeler is reversible to provide double wearing life. The rubber covered impeller lasts about three years for average ores.

Capacities — The Agitair treats greater tonnages per unit of machine volume, than other types of machines. The machine is built in 2, 4, and 6 cells units, that can be bolted together to provide the required capacity and is available in a number of sizes to suit individual needs, including laboratory cells and units for continuously operating Pilot Plants.



Agitair Pilot Machine, Illustrating Counter Froth Flow Flotation Method.

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AUGUST, 1942

Volume 143 Number 8

Latin America—Mining Frontier

ONE OF THE EARLY RESULTS of the war in Europe, particularly as it entered the phase that called for Western Hemisphere defense and solidarity, was to focus attention sharply on the mineral resources of Latin America. Although their importance could not then be foreseen and appreciated, subsequent events demonstrated the critical dependence of the United Nations on Latin American copper, tin, zinc, iron, manganese, tungsten, and other metals that could be brought to the United States for fabrication into munitions and war machines. Indeed, the combined developed resources of the entire Western Hemisphere ultimately proved insufficient, and the shortages must have been much more serious but for the contributions of the countries South of the Mexican Border.

Step by step, as the war progressed, the United States Government took official cognizance of the vital need of all the critical metals and minerals that Latin America could produce. The Bureau of Mines and the Geological Survey placed technical personnel at the disposal of our neighbors for exploration and development of their mineral resources. Financial assistance was arranged through the Export-Import Bank. Cooperating with other government agencies, the Coordinator of Inter-American Affairs showed a lively interest in Latin American mineral industries, and the Metals Reserve Company became the ready customer for all the war metals and minerals that Latin America could supply. The Board of Economic Warfare encouraged and facilitated the importation of needed ores and minerals. Finally, through the Mining Branch of the War Production Board, Latin American mining companies have enjoyed the same priority ratings as United States and Canadian operators, limited only by shipping facilities. In short, in the mineral industries the good neighbor policy has been effectuated by the United States to the limit of its resources.

A high degree of inter-American coordination and solidarity having thus been achieved, it is timely to gain a wider knowledge of the mineral resources of Latin America. Not only are they playing a vital part in the war, but they will be an important factor in the post-war economy of this Hemisphere. To an ever increasing degree their development will afford opportunity for men, machinery, and money from the United States, and will be basic to local industrial growth throughout Latin America that will gradually raise the standard of living throughout the Southern Hemisphere.

What, then, are these resources that promise so much for the future? In an attempt to answer that question in broad outline, *Engineering and Mining Journal* publishes this Latin America Number. Generous credit is due our contributors, who, in large part, are native to the countries of which they write, and who hold official positions of authority and responsibility in their respective Governments. Each has outlined the active mining industry of his country and has sketched its known but undeveloped mineral resources. From the latter one may justifiably draw the conclusion that South America is a mining frontier, the conquest of which has only begun, and the development of which will round out the mineral economy of the Hemisphere from the Arctic to Cape Horn. To the extent that North Americans participate financially in this evolution, they will be wise to embark on ventures as partners with native investors, and thus merit the interest and cooperation of local Governments in their undertakings.

A Mineral Map of Latin America, specially prepared from data furnished by contributors to this number, is published and mailed as a supplement to this issue of *Engineering and Mining Journal.*

Lullaby Publicity

FOLLOWING CLOSELY upon the "streamlining" of the Bureau of Mines, discussed in these columns last month, Secretary Ickes' publicity department issued a series of releases featuring technical achievements of the Bureau and announcing plans for new plants and processes to develop the mining industry and the West. At the risk of incurring criticism from those who obviously stand to benefit materially from Federal spending, we feel it our duty to remind the mining industry that the current proposals fit precisely into the pattern of Mr. Raushenbush for putting the mining business in the hands of the Government. As long as that worthy is in a position to plan the strategy of the Department of the Interior, one may well question the face value and forthrightness of Mr. Ickes' ambitious and aggressive plans.

A Message to Miners

THIS EDITORIAL is addressed to the army of technical men, foremen, and workmen who comprise the backbone of the mining industry, and whose strength and skill are necessary to produce the metals so vital to national security. We urge you to give thought for a moment to the significance of current developments in the Bureau of Mines, and to their impact on you and the industry of which you are a part.

Not being primarily capitalists, what's your stake in private enterprise? What's it to you whether you work for private capital or a socialist Government?

Simply this: notwithstanding many imperfections and injustices, private enterprise operates primarily on the basis of merit and efficiency. In most cases the best man gets the job. In most cases the man who contributes most reaps the greatest reward. By contrast, under socialism men work for the Government; and inescapably a new factor, politics, enters the picture. By the same token, merit and efficiency wither and decay.

If you have a stake in private enterprise, and we believe you have, you are vitally concerned with what Ickes, Raushenbush, *et al,* are doing toward putting the Government into the mining business. The "streamlining" of the Bureau of Mines and the grandiose facilities now being developed, ostensibly to aid the industry and the war effort, are suspiciously close to the technique of "encroaching control" over the basic industries which Raushenbush advocates to his revolutionary associates. He frankly advises them that the working masses in this country have too many opportunities for personal advancement under our present system to make them willing to support a violent revolution.

What can you do about it? Without relaxing for a moment your important contribution to the war effort, you can express your feelings to your Senators, Congressmen, the President himself. You can ask them to call a halt on the activities of the social revolutionists, so that the nation can concentrate on the job of winning the war.

Labor Shortages and Price Ceilings

IT IS EVIDENT that mine labor shortages are becoming serious enough to threaten the whole war production program. WPB warns the public not to be alarmed if some recently finished war plants are unable to operate, or must do so on short schedules, for lack of raw materials to permit full-tilt production. The program is represented as being in a "balancing out" stage, wherein plant production must wait upon fruition of a slower program of expanding raw material production. We doubt that the matter is as simple as that, and wonder how mineral raw production is to be expanded when labor shortages threaten maintenance of even the present rate of output.

In seeking a solution, one can too easily jump to the conclusion that workmen must be "frozen" in their jobs, or that efficient production can be maintained by forcing men back into the mines from newer, higher-paid jobs in shipyards, war plants, or construction projects. We share the fear that such a cure might be worse than the disease. Nor can we overlook the case of the workman whose living costs have risen because of political cowardice in treating wage-price problems as a series of unrelated factors.

Although we are as terrified as anyone over the prospect of uncontrolled inflation, we still wonder whether the logical solution to the mineral raw material problem does not lie in raising present price ceilings on metals of which we have an insufficient supply, increasing premiums for over-quota production, and abandoning the discriminatory application of quotas to the disadvantage of large producers. Referring to the last point, we cannot imagine any effective program to boost mineral and metal production without developing the full use of the resources, plants, and personnel of the "big fellows," and ceasing the unfriendly attitude displayed toward them. The extraordinary importance of metals in modern war probably justifies extraordinary measures to insure an adequate supply.

Reflections from Washington

SHORTAGES of steel, copper, and other raw materials are now operating as a brake upon the whole war production program. Donald Nelson admits that the premium price program has failed to provide the increases in output of copper that were estimated. As a result, industrial operations based on these estimates are being held up. The acuteness of the steel shortage is pointed up by the cancellation of the Higgins shipyard construction contract with the Maritime Commission, and by the suggestion of Robert R. Nathan, chief of the Planning Division of WPB, that some newly-finished or unfinished war plants may have to be torn down to recover the raw materials used in their construction.

These disturbing developments are coming to light simultaneously with the realization that essential mines throughout the country face curtailment of their present outputs because of labor shortages, induced principally by wage competition of war plants and cost-plus government construction projects. Living under government-imposed price ceilings, mine and smelter operators have no means of offering wages that are competitive to those being offered to their employees. This condition, which regional news columns of *E.&M.J.* have portrayed as developing for months past, was highlighted during recent hearings held in Western mining centers by Senators McCarran and Murdock of the Senate Special Committee on Silver (see p. 127). No solution seems even remotely in sight. The forcible transfer of workmen back into their customary field from more lucrative jobs, or adopting Senator McCarran's suggestion of putting the Army in the mines, are more drastic moves than a reconciliation of wage policies with the price policies necessary to prevent an inflation disaster. Even on this last, more fundamental subject, future government policy is obscured by political pussy-footing on the part of both Congress and the Administration.

Explosives Control Enforcement

THIS SUMMER the metal mining industry will begin to feel the force and effect of the provisions of the Federal Explosives Act governing the storage, handling, and use of explosives in time of war. The Act was approved on Dec. 26, 1941, and revised regulations authorized thereunder were issued as of June 22, 1942. In late July the Bureau of Mines, which

Washington News Bureau

is charged with the administration of the Act, was engaged in distributing instructions for the guidance of investigators and other representatives of the Bureau who will undertake to see that users of explosives comply with the regulations. These investigators have been in training for some time and will soon go into the field.

The Act provides that manufacturers, distributors, and users shall procure annual licenses to make, sell, buy, or use explosives, obtaining an appropriate license for each activity. Accurate records must be kept and reports must be made. Punishment is provided for violations. The regulations contain special instructions for industries using explosives, covering care in storing and handling, and relating to the licenses, records, and reports required. The Act is being administered by the newly created Wartime Mineral Production Security Division of the Bureau, of which J. J. Forbes is chief, and over which Dan Harrington, chief of the Health and Safety Service, exercises general supervision. Operators can secure copies of the revised regulations by addressing the Production Security Division, Bureau of Mines, Washington, D. C.

Production Requirements Plan

LAST month, *Reflections* stated that smelters and refiners using more than $5,000 worth of listed forms of metal for maintenance, repairs, or processing into unlisted forms would have to apply for such needs under PRP. In mid-July, WPB reversed itself, and decided that all smelters and refiners would be kept under P-73 for the third quarter.

Now, however, the form of application to the WPB mining branch for materials quotas, such as those called for in Section 1 (ii) of Order P-56, is being geared to the PRP machinery. Bulk of the larger companies, including both mining and smelting (those using $5,000 worth of materials on the Metals Control List, as revised in July), are being directed to apply for their quotas on the PD-25A form used by concerns operating under PRP. Companies not sent a PD-25A form will apply in the usual manner for their quotas of the amount of material to which they can apply ratings.

These internal moves have not reached the point where they have any effect upon the relation of the industry and the branch, or upon the industry's procedure in applying or obtaining repair and maintenance ratings. Requests for emergency priority aid will continue to be made as at present to the mining branch by all concerns operating under Orders P-56 (all Western Hemisphere mines), P-58 (certain South American copper mines) and P-73 (smelters).

If this plan sticks, it will postpone and perhaps obviate a threatened splitting of the industries affected into two groups—those requiring more than $5,000 worth of "control" metals in a three-month period using PRP and the others remaining under the present industry orders or being transferred to some small-company version of PRP.

P-73 and P-58

EFFECTIVE JULY 14, Preference Rating Order P-73 was revised to permit smelters and refiners who have been issued serially numbered copies of the order to exercise an A-1-e rating by endorsement for 25 percent of the dollar value of material acquired during a calendar quarter for repair, maintenance, and operating supplies. The remainder of their purchases can be made with an A-3 rating, also created by endorsement. The entire quarterly quota of purchases allowed on these two ratings is 60 percent of the dollar value of total purchases made for repairs, maintenance, and operating supplies during the six months' period June to November, 1941. The provisions for an A-1-a rating, for breakdowns, available by special permission, and the A-10 rating, created by endorsement, for other requirements, remain unchanged from the previous order. Suppliers' acceptances and reports are no longer required.

Effective the same date, Preference Rating Order P-58 was revised to permit South American copper mines which have received serially numbered copies of the order to apply an A-1-a rating to 25 percent of the dollar value of material ordered for maintenance, repair, and operating supplies during a calendar half year. A-1-d ratings may be applied to 35 percent, and A-3 ratings to the remainder. All these ratings are created by endorsement of purchase orders. Total quotas upon which the above ratings can be exercised are limited to 125 percent of the dollar value of total purchases made during the previous half year for maintenance, repair, and operating supplies. Monthly reports are required.

New Endorsement for Blanket Ratings

PURCHASE ORDERS bearing priority ratings applied under Orders P-56, P-58, and P-73 are now required to carry a new form of endorsement which an amendment in Priorities Regulation No. 3 makes standard for all users of the various "P" order procedures. The certification is to be worded as follows:

"The undersigned purchaser hereby represents to the seller and to the War Production Board that he is entitled to apply or extend the preference ratings indicated opposite the items shown on this purchase order, and that such application or extension is in accordance with Priorities Regulation No. 3 as amended, with the terms of which the undersigned is familiar."

Name and address of the purchaser, together with the signature and title of the purchasing officer and date, are required below the endorsement, and the mining division also requires that such orders carry the priorities order number under which the order is placed (P-56 etc.) between the certification and the signature.

Zinc Pilot Plant

THE Bureau of Mines has announced that it will build a new zinc reduction plant, to cost $350,000, somewhere in the south central part of the country. Purpose is to test a laboratory method, worked out several years ago, of reduction by methane instead of the coke commonly used in retort smelting. The Bureau claims that the process has been found superior in several instances to commercial methods now in use. How this can be demonstrated before the process has reached the pilot-plant stage was not explained. The plant is expected to have a capacity of 500 lb. of zinc per day. Location is not yet decided, but presumably will be in an area of cheap gas, with favorable transportation.

WPB Reorganization

SEPARATION of the policy and operational units of the War Production Board through Donald Nelson's July "realignment" is materializing from the top down. Early in August, a regrouping of the industry and commodity branches under the new Director General of Operations, Amory Houghton, was being worked out but was not complete.

The purpose of the reorganization is to keep the war agency abreast of the changing administrative job, from one of building a vast war plant to one of running that plant, as outlined in *Reflections* for July. Important fact for the mining industry is that, generally speaking, the branch staffs will remain largely the same, and Washington contacts will be unbroken.

Metal Controls Relaxed

FIRST EVIDENCE of government willingness to relax controls over metals when supply situations ease came in July for both antimony and lead. Changes in Order M-112 remove from the allocation program deliveries of 50 tons or less of antimony ores and concentrates. Further, small consumers are authorized to receive up to 25 lb. of contained antimony monthly outside WPB jurisdiction, and some of the restrictions on use of the metal in pigments have been modified. Following the same trend, the monthly lead pool has been discontinued until further notice because the government stockpile is considered large enough for the moment.

Lead is now the only important metal listed as available in quantities sufficient to provide some non-essential civilian uses.

Manpower Problem

RECOGNITION that mining, both metallic and non-metallic, and smelting and refining, are essential civilian activities engaged in support of the war effort came in a policy directive from the War Manpower Commission in July. This means that men with dependents in these industries, regardless of occupation for the time being, are entitled to be rated or re-rated into the relatively new classification of 3-B. It means, also, that men without dependents in these industries are also to be considered as engaged in essential activity, but the question of whether they are to be drafted or deferred hinges more directly upon the essentiality of the individual job. Guiding lists to help local boards determine which job classifications are essential to the mining of minerals needed in the war effort were issued by Selective Service early in August as Occupational Bulletin No. 12. It is anticipated that similar action will soon be taken affecting smelting and refining.

Enactment of the dependency allowances legislation carrying legislative instructions for calling all family workers after exhausting the lists of both essential and non-essential non-family workers became effective in July. This means that all single men, regardless of occupation, are to be subject to induction ahead of men with families. There will be exceptions, of course—the Class 2 category of occupational deferment remains; but the pressure upon employers to obtain substitutes for this group of workers will increase.

All of the matters referred to in the foregoing pertain to the competition between the military services and industry for manpower. In the field of industry vs. industry competition for the shortening labor supply the McNutt Commission is moving much more slowly. Mild federal controls over labor raiding are in the offing for such areas as Detroit rather soon. Voluntary industry agreements will be attempted before any order requiring that all employment clear through the United States Employment Service is issued, but this eventuality is generally anticipated sometime this fall. Politicians are unwilling to apply compulsion to labor until after elections.

Mine Lessee Status

THE ADMINISTRATOR of the Wage-Hour Act has issued a new set of directives governing the attitude of the Wage-Hour Division of the Department of Labor toward mine lessees. As heretofore, the division will treat each case as a separate problem. The directives summarize as follows: "Lessee must not work under such supervision of lessor as would indicate an employee-employer relation; the relationship is subject to special scrutiny where lessor furnishes all or most of the equipment; lessee must select, hire and fire his own employees, if any, and pay them and any Social Security or other taxes incident to their employment; lessee must be free to dispose of his ore without undue disadvantage; and the lease must be for a definite period of not less than six months and not be arbitrarily cancellable by lessor in case of a lucky 'strike'."

U. S. Will Subsidize Canadian Development

ACTING in conjunction with G. C. Bateman, Canada's Metals Controller, and Wartime Metals, Ltd., a Canadian government corporation, the Reconstruction Finance Corp. has arranged to advance money for prospecting and developing deposits of war metals and strategic or critical minerals throughout Canada, production to go to the United States. It is anticipated that this assistance will facilitate the opening of properties already known as well as the search for new mines. Inasmuch as development of submarginal properties is planned, it can be assumed that some form of subsidy for low-grade operations will be employed.

To maintain Canada's output of war metals and minerals, by conserving labor and equipment, Bateman has ordered all mines to refrain from expanding their output except by special permission. No new mines can be opened without his consent. To conserve labor for base-metal operations, Canada's Selective Service has ordered British Columbia gold miners not to hire new labor until essential mines are supplied. Canadian base-metal miners have been exempted from the draft to prevent further drainage of the already seriously depleted mine-labor supply.

(*Continued on p.* 160)

CHILE

Its name synonymous with copper, Chile also produces iron and has resources in several ferroalloy metals

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MINING is an ancient industry in Chile—older than the discovery and conquest of the country itself by the Spaniards, and much older than the industry in the United States and Canada. Alluvial mining was carried out in a primitive manner by the aboriginal tribes of northern Chile in order to gather and pay their annual tribute to the more warlike Inca Emperors, who, in their campaigns of expansion, had extended their domains as far as Central Chile.

When Diego de Almagro, then a friend and partner of Pizarro, the conqueror of Peru, came south from Cuzco in his voyage of discovery and conquest, he did so under the illusion that the country which he meant to conquer was far richer in precious metals and stones than Peru itself. It is said that he was intentionally deluded into believing this fable by the Peruvian Indians, who, realizing the all-pervading desire for gold which possessed the Spaniards, hoped to get rid of as many of them as possible by this ruse. Pedro de Valdivia, the enterprising and indomitable conqueror of Chile, was also the country's first European miner; but as such he was not more successful than his predecessor Almagro. As a mining country, Chile was very much of a disappointment until after the declaration of independence, because gold, the heart's desire of the Spanish adventurers, has never been plentiful in this country.

Chile acquired much earlier than any other South American republic the political stability and social order so indispensable to the development of the mineral resources of a nation. Being very long and narrow, with a coast line many times greater than that of any other country of its size—2,600 miles long—the ores can be easily and cheaply transported to the ports for export. The climate is temperate and healthful; labor plentiful, hardy and efficient; and the mining laws are probably more generous to the miner than those of any other country in the world.

From the early days of independence until the years of the war with Peru and Bolivia in 1879, Chile exploited with preference the great silver and copper bonanzas situated in the Coast Range. After Chile acquired the provinces of Tarapacá and Antofagasta, where the great deposits of natural sodium nitrate occur, she had a virtual monopoly of this most important fertilizer and explosive ingredient until the war of 1914-1918 gave a great impetus to the synthetic manufacture of nitrogen compounds.

Chile's Present Mining Industry

Copper ranks foremost today in the mineral production of Chile, having last year reached a total of 457,000 metric tons of electrolytic and blister copper with an approximate value of $97,000,000. This is an all-time record and sure to give Chile second place among the copper producing countries of the world. Of this total, 95 percent represents the output of the three great Chilean copper porphyries known in the country by their historical names of Chuquicamata, Potrerillos, and El Teniente and in the States as Chile, Andes, and Braden, respectively.

Chuquicamata, besides having a mouthful of a name, as someone said, can also boast of greater reserves than any other copper deposit known—more than a billion tons of 2 percent copper content. As the mine has not been bottomed by drilling, and the horizontal extensions have not been determined, it is possible that the total reserves may be much larger. I was told in New York by the late Mr. Bellinger, one of its great general managers and to whom much of the success of Chuquicamata is due, that after taking the father of the porphyries, D. C. Jackling, over this huge deposit, the latter, no mean judge of orebodies, exclaimed in admiration, "This is the nearest thing to infinity that I have seen in an orebody."

Though Chuqui is not mining 100,000 tons of ore a day as Utah is doing at present, there is no reason why she should not do so if need should arise. Besides, its grade of 1.65 percent copper is double that of Utah; and though it does not produce molybdenum and gold as byproducts, I would venture the guess that their cost figures do not stand very far apart. In a few years

Concentrator and general housing facilities at Braden Copper Co. at Sewell, Chile

comparisons between Chuqui and Utah will be more interesting, because the two greatest copper mines of the world will be beneficiating their ores by the same processes—flotation and smelting.

Andes Copper has turned out to be the Cinderella as well as the youngest of the Chilean porphyries. Its reserves were estimated at 137,000,000 tons of 1.51 percent copper in 1924, and at present they stand at 95,000,000 tons averaging 1.48 percent copper. At Andes the metallurgy was complicated by the fact that both sulphide and oxide ores were found and had to be mined more or less simultaneously. As a consequence, Andes can boast of a flotation mill, leaching plants for coarse and fine ores, an electrolytic tank house, and a smelter. When in 1924 the public was asked by Anaconda to become a partner in the enterprise, the cost of producing copper at Andes was estimated at 6.672c. per pound, but not even the worst of pessimists would have ventured to predict that the price of the red metal would have fallen to 5.57 and 6.73c. per pound as it did in 1932 and 1933.

However, the crisis in those fateful years hit Chile so hard that foreign exchange fell to unheard of figures, and as a consequence the dollar rose from 8 Chilean pesos to 60. As all labor employed is Chilean and is paid in Chilean currency, this meant a considerable saving in cost of production for the Chilean porphyries. Today the dollar is worth 31 pesos. Maximum output by Potrerillos was reached in 1929, when 81,500 short tons of copper was produced.

Braden Copper Co. was formed as far back as 1904 by William Braden, who thus did for the Chilean porphyries what Mr. Jackling had previously done for her northern sisters. Braden reserves stand today at 300,000,000 tons of 2.2 percent copper ore and can produce 120,000 tons of copper per year. As the mine is at an altitude of 10,000 ft. above sea level, in Central Chile where erosion is strong, in contrast with Chuqui and Andes, the speed of denudation can keep pace with the rate of oxidation, and this property is not encumbered with oxide ores and the consequent complexity of having to handle two different classes of ore. Besides this advantage, its location in Central Chile where water is plentiful and rivers have high gradients, Braden can boast of cheap hydroelectric power in two plants which generate 40,000 kw. Thus the Braden management will not have to worry about a possible shortage of fuel oil for power purposes in war time.

The Braden mill has grown from a modest 250 tons per day—an all-gravity plant with Chilean mills, tables, and vanners—to one of the most up-to-date and efficient flotation mills handling 27,000 tons of ore a day. Braden, like Utah and Chino, is also recovering molybdenum from its copper concentrate by differential flotation. In 1941, 336 tons of molybdenum concentrate was exported to the United States. This year, according to present indications, production will undoubtedly be much greater.

Development of the copper porphyries has been, without a doubt, a godsend to Chile, coming as it did at a time when the nitrate industry was fighting hard for its existence and being driven slowly but surely from the world's markets in which it held undisputed sway for many decades. During the prosperous years of 1916-1917 and 1917-1918, Chile produced close to three million metric tons of sodium nitrate a year. As nitrate had to pay to the government an export tax of about $11 per metric ton, this tax netted the Chilean treasury about 300,000,000 pesos a year in good years, which was sufficient to pay for about half the national budget. About 15 years ago, Chile was compelled to withdraw this tax to enable the nitrate industry to survive. Copper has slowly been taking the place of nitrate as a source of income in the national budget, though since the export tax on nitrate was taken off, income and various other taxes had to be levied to balance the budget.

The American-owned copper mines in Chile employ about 18,000 men, who draw higher wages than those prevalent in the rest of the country. The national railroads transport part of the copper to the ports; timber and other supplies are bought locally, as well as all the food and clothing the men require. When all this is taken into account, as well as the income tax and other taxes which the American companies pay to the State (not forgetting the new tax which will net at the present price of copper about $12,000,000 a year and which will have to be paid when the price of copper is above 10c. a pound), nobody can deny that if it is true on the one hand that the Chilean porphyries have turned out to be a splendid investment for the American investor, they are also rendering considerable help to the country in taxes, wages, and salaries and all sorts of supplies which are bought locally.

Besides the great investments made in the copper mines just briefly reviewed and which are worked just as efficiently as the American porphyries so familiar to the readers of *Engineering and Mining Journal*, foreign capital has been represented in the mining industry of Chile for nearly fifty years in the two French copper smelters of Chagres and Naltagua, located in Central Chile within 60 miles of the capital, Santiago. Each of these smelters produces at an average rate of about 7,000 tons of blister copper a year, using reverberatory furnaces and burning Chilean coal of about 6,000 calories (10,800 B.t.u.). Both smelters are of American design, having been built in 1917-18 by Allis-Chalmers Manufacturing Co.

The basis for the charge at the Chagres smelter is the concentrate produced at the two company flotation mills of El Cobre and Caracoles, where, respectively, 550 and 120 tons of 3 percent ore are treated per day. Ore reserves at the two mines which supply these concentrators stand at about 2,000,000 tons of 3 percent ore. Naltagua can be classed as a custom smelter and it has reduced for a considerable number of years the copper concentrate produced by the Cía. Minera Disputada de las Condes in its 500-ton mill. The Disputada mine has turned out to be a most interesting deposit where the ore occurs in a tourmaline breccia within a great granodiorite batholith at 13,000 ft. altitude and only 40 miles from Santi-

ago. Ore reserves at this mine stand at 4,500,000 tons.

Both these smelters treat appreciable tonnages of copper and gold concentrates produced in Central Chile, besides most of the copper and gold ores mined from the port of Coquimbo, south.

The Smaller Copper Mines

When Chile ranked first as a copper producer among all the nations of the world, most of the ore was won from the high-grade veins along the Coast Range in the provinces of Aconcagua, Coquimbo, and Atacama. These veins are also related to the extensive granodiorite intrusions which are so frequent in this range. Many of these mines attained depths of over 1,600 ft., and one, the Dulcinea vein, in Atacama, 3,300 ft.

Today the following companies concentrate their ores in flotation mills: Tocopilla, with two concentrators of 350 and 700 tons a day capacity at Tocopilla and Ovalle; Ojancos, at Copiapó; Farellón Sánchez, with 120 tons a day; Merceditas and Volcán, with 100 tons per day each, and Carlota, with 400 tons, all in the Maipo valley near Santiago.

Besides the mines which supply these mills, some of which are not working, the small mine owners exploit in a rather primitive manner literally hundreds of mines and prospects which extend from Central Chile to the Peruvian frontier. On an average good year, and depending on the price of copper, these mines yield around 50,000 tons of ore running 9 percent copper, ½ oz. gold, and 2½ oz. silver per ton.

Estimating the whole of the copper production of Chile for 1941 at 469,000 metric tons, the three American owned mines account for 444,000 tons, or 94.6 percent; the French copper smelters for 13,000 tons, or 2.8 percent; and the smaller mines and the concentrates for 12,000 tons, or 2.6 percent.

Probable Mineral Production of Chile in 1942

Product	Quantities	Price, Dollars per unit	Estimated Value, Millions of Dollars	Men Employed
Copper, metric tons	500,000	$0.1175 lb.	130.00	30,000
Sodium nitrate, metric tons	1,500,000	34.50 ton	51.75	24,000
Iron ore, metric tons	1,750,000	1.15 ton	2.0	500
Manganese ore, metric tons	60,000	18.50 ton	1.11	1,000
Mercury, flasks	3,000	190.00 flask	0.57	.....
Molybdenum concentrate, tons 90% MoS_2	1,000	900.00 ton	0.90	.....
Gold, troy oz	320,000	30.00 oz	9.60	30,000
Coal, metric tons	2,200,000	6.50 ton	14.00	15,000
Sulphur, metric tons	35,000	32.00 ton	1.12	3,000
Silver, troy oz	1,500,000	0.30 oz.	0.45	.....
Iodine, tons	1,000	3,500.00 ton	3.50	.....
			215.00	103,500

Gold

Gold has been mined in this country without interruption since the days of the conquest and even before that time by the natives, but only after 1932 did gold mining really become profitable. Chile, like all Latin American countries, is a producer of raw materials, and in our case these are mostly metals, nitrate, and minerals. After the great crash in 1929, Chile found itself without markets for its mineral products; and though a really great effort was made to prevent inflation and keep the peso at the fixed rate of 6 pence, such efforts proved useless and the dollar rose from 8 to over 60 pesos in 1932 and the value of 1 gram of gold from 5.40 to 40 and more pesos. As a consequence, the miners turned their attention to gold instead of copper and even the thousands of idle workers from the nitrate fields were put to work by the government in the gold placers in Central and Southern Chile.

Production of gold, which had remained at around 1,000 kg. (32,000 oz.) per year, mostly derived from copper ores and concentrates, has risen in ten years to over 10,000 kg. (320,000 oz.), per year. The production of placer gold has decreased steadily year by year as the economic recovery of the country permitted more remunerative employment in vein mining and other fields of endeavor for the gold washers; and the output of lode gold has mounted slowly but surely. This has been due to the far-sighted policy of Caja de Crédito Minero in furnishing the small miner with a sure and equitable market for his low-grade gold ores, which, before this institution was created, could not be disposed of anywhere. It has enabled the small miner to keep on working, even though most of the time he might be obtaining only the barest subsistence from his mine in the hope of striking it rich the next day, as real miners always do. As a consequence, richer oreshoots have been discovered and many small mines which at the outcrops were poor and disappointing have turned out to be real money makers for their owners.

Though many thousands of gold mines have been discovered and worked in the last ten years, the number of those which have developed from small prospects into really good sized mines has been remarkably few.

Among mines that have yielded either high-grade ores or that have persisted in depth, mention should be made of the narrow, flat-dipping and rich veins of the Altamira district near Taltal; the wider and very rich gold-copper veins of La Isla, at Inca de Oro, north of Copiapó; the remarkable Capote vein which was worked by the Indians and which boasted of a well-defined and rich oreshoot of appreciable length; the new mine of Tres Amantes, east of Copiapó, rather unique geologically because the quartz oreshoots

Open-pit mine of Chile Copper Co. at Chuquicamata, Chile

are irregular in shape, of little depth, and are found in the same impure Mesozoic limestone where the once famous Chañarcillo silver veins occur; the Andacollo low-grade deposits—less than 0.1 oz.,—where occasionally very high-grade stringers are found containing gold in the form of ribbon or wire. (In this field two flotation mills handling 450 tons per day have been built.) And lastly, Bellavista, a fairly wide vein containing 8 g. of gold per ton besides copper and zinc.

Though further north than Bellavista near the town of Ovalle, I have left Punitaqui purposely to the last because this really extraordinary orebody has proved to be by far the best gold mine open in Chile since inflation increased the price of gold six times in relation with what it was in 1932. This deposit consists of a wide quartz vein in porphyry near the contact between this rock and the granodiorite formation of the Coast Range. The vein seems to represent a fracture zone having an average width of 26 ft. of minable ore running 8 g. of gold (0.25 oz.), less than 1 percent of copper, and carrying appreciable values in mercury. The mercury occurs as cinnabar in a definite oreshoot, and outside of this shoot the grade of mercury is too small to recover. The known length of the lode is considerable, about a mile, and it has been opened to a depth of 500 ft. The ores are concentrated by flotation in a mill which handles 400 tons of ore per day. The mercury ore is treated in one of the two sections of the mill (each of 200 tons' capacity) quite apart from the gold-copper ore, and a flotation concentrate made which runs 20 percent mercury and 200 g. of gold to the ton. This is distilled in the usual cast-iron retorts which are oil-fired. Production for the second semester of last year amounted to 10,700 oz. of gold, 278 tons of copper, and 1,280 flasks of mercury.

Considering the great depth at which gold is mined at Morro Velho, Brazil; on the Rand; in the Kolar gold field of Mysore, India; and even in some of the Canadian gold mines, the gold mines of Chile have proved as a rule to be very shallow, the greatest depth attained so far being that of Las Vacas mine, in the Aconcagua province of Central Chile (1,300 ft). Though a debatable point for geologists to elucidate, experience seems to indicate that in the great majority of the gold veins exploited in Chile, commercial ore is found only in the so-called zone of secondary enrichment where the gold occurs free from its usual sulphide mineral associates: pyrite, chalcopyrite, and arsenopyrite. In most of the gold mines so far worked in this country, when the primary zone containing the unaltered pyrite is reached, the grade decreases so appreciably that the ores are no longer workable. The veins in porphyry or granodiorite reach greater depths than those found in the sedimentary rocks, and in both types the tellurides are very rare. The great majority of the gold veins are narrow—widths greater than 3 ft. as at Punitaqui, are scarce—and are situated in the desert regions of Northern Chile (mostly in the provinces of Atacama and Coquimbo). By far the greatest number of the gold deposits—and most of the copper and other metals—are genetically related to the great intrusions of granodiorite so common in Chile and which form a part of the Maritime Range of mountains.

Practically all the gold veins so far found are within the Coast Range or in the longitudinal valley which runs north-south practically the whole length of the country. Some have been discovered in the first range of hills east of this great north-south running valley which make up the first spurs of the Andes Mountains. Few gold veins have been found in the high Cordillera.

Iron

Chile is generously endowed with high-grade iron deposits, all well located at fewer than 20 miles from the coast. Of these the best known is that of El Tofo, owned by the Bethlehem Chile Iron Mines Co. and located a little north of the port of Coquimbo. This deposit consists of a capping of magnetite largely altered to hematite and is 2,800 ft. long, 660 ft. wide, and averages 530 ft. in depth. Grade is 60 percent iron, with 0.05 percent phosphorus and 7.5 percent silica.

Development operations began in 1913 and shipments of ore to the United States in 1922. To reach this stage it was necessary to build loading docks and a port which had to be excavated in hard rock under the sea; a 7,000-kw. power plant at the port; a 15-mile electric railroad from the mine to the port; and a crushing plant and storage bins at the mine. With these facilities a 20,000-ton ship can be loaded in a few hours. The ore is mined by the open-cut method using Marion electric shovels. Between 5,000 and 10,000 tons of ore and waste is handled per day, ratio of ore to waste being 2 to 1. The tonnage developed at this mine was 65,000,000 tons, but of this total a considerable part has already been mined. Maximum production was reached in 1929, with 1,779,000 long tons. Last year 1,689,000 tons was mined. Recently this company has acquired the Romeral deposit, which is situated between El Tofo and the town of La Serena, 15 miles inland. The tonnage developed has not been made public and the ore is said to be similar to that of El Tofo.

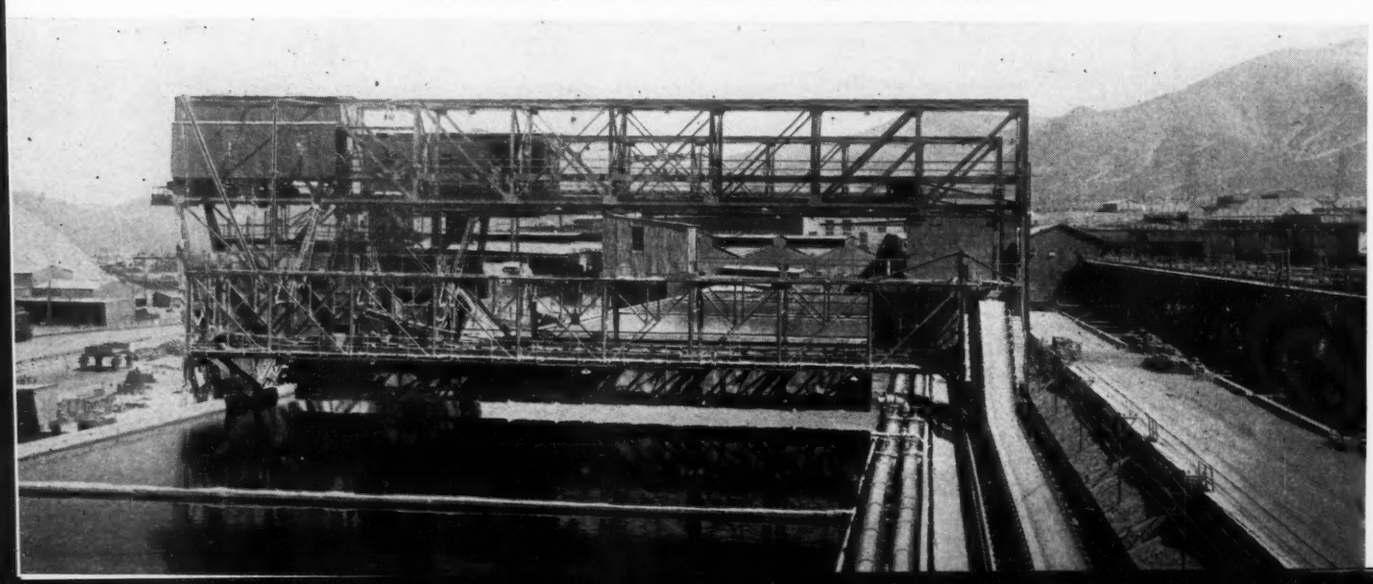
Sulphur

Sulphur deposits of the volcanic or surface type are plentiful in Chile along the high Cordillera from the Peruvian frontier to about 36 deg. south latitude, the principal known mines being around Mount Tacora in Arica and those of Ollagüe and Aucanquilcha, near the Bolivian frontier in the Antofagasta province. The high-grade ores, above 60 percent sulphur, are reduced in stationary vertical or horizontal rotating autoclaves using steam and superheated water. The sulphur produced is 99.5 percent fine. Maximum production was in 1938, with 21,000 tons of crude sulphur.

Coal

Chile produces about 2,000,000 tons of coal a year from the Tertiary coal fields situated in the south near the town of Concepción. Of the total out-

Copper leaching tank installation of Chile Copper Co. at Chuquicamata



put, two companies, Lota and Schwager, both Chilean owned, produce 92 percent. Owing to the increasing demand for fuels on account of greater industrialization of the country, a shortage of coal has been felt in the last two years, and as a consequence a program for increasing output to 3,000,000 tons a year is under way. This program comprises both greater turnover from the producing mines such as Lota, Schwager, Curanilahue, Lirquén, Cosmito, and others, and a development campaign in known fields and drilling in probable ones which has been undertaken and is being energetically carried out by the Caja de Crédito Minero. The probable total coal reserves of the country have been estimated by the Chilean Bureau of Mines at 225,000,000.

Undeveloped Mineral Resources

The northern half of Chile, extending from Braden Copper 50 miles south of Santiago to the boundary of Peru, has been well prospected since 1810, the eventful year when independence was declared and the country opened to foreign enterprise, capital, and trade. Consequently no numerous nor great ore deposits are likely to be found that can be located by the classic methods of prospecting, as the Chilean prospector is recognized as among the best in the world and not likely to pass over anything of real merit in a country so beautifully made for prospecting. However, in this long stretch of country not all the deposits found are being worked. In the northern provinces of Antofagasta and Atacama are several promising and fair-sized copper mines where the metal is found in the oxide form. As is well known, the climate in northern Chile is very dry; oxidation has penetrated to great depths, and erosion on account of absence of rain and snowfall is practically nil. Owing to the fact that the capital outlay for a leaching plant is much greater per ton of capacity, and the metallurgy more complicated to work out, than that required for the flotation of the simple sulphide minerals of copper, capital has not been tempted to develop these well-known oxide copper deposits, which require a considerable outlay for acid, leaching, and electrolytic plants besides that necessary for drilling, developing, and equipping the mine, and building camps and roads, which, in any case, are also required for a flotation mill. There is also the added difficulty that if the ore persists in depth and sulphides are found, another type of reduction plant would be required, as shall be the case with Chuquicamata and was with the Ajo mine, thus increasing the total capital outlay needed to exhaust the mine. Among these deposits, mention should be made of the Sagasea, Sierra Valenzuela, Michilla, Huanillos, Mantos Blancos, Manto Verde, and some others of smaller importance.

I do not expect that many important gold mines will be opened up in the future, as gold has been prospected for a longer period—over four centuries—than any other metal or mineral in Chile. Two favorable regions may be worked in the future if much larger-scale operations are undertaken. One of these is Andacollo, where large tonnages of low-grade ore—less than 0.1 oz.—are known to exist. The other possible future source of gold is the coast region which extends south of Ovalle as far as the latitude of Combarbalá and where low-grade ore bodies exist at the contact between the granodiorite on the east and the ancient crystalline micaceous slates which extend to the seashore. Trese latter orebodies have been little developed.

Manganese deposits are of the replacement type, mostly in limestone, and I have described them in detail in *Engineering and Mining Journal*, October 1941. It is unlikely that new ones will be discovered. Future exploitation in time of peace will depend on price, better methods of mining, and the success that may be attained at concentration. In size and grade they cannot compare with those of Russia, India, Africa, and Brazil.

The outlook for sulphur depends on whether a really efficient and economic method of treatment can be found that will solve the metallurgical riddle which the volcanic type of sulphur ores present. The mines are situated at high altitudes, between 13,000 and 19,000 ft. above sea level, near the volcanic peaks of the Andes where climatic conditions are such that only Indian labor accustomed to the Bolivian plateau can stand it for long. At present, a suitable market for Chilean crude sulphur has been found in Brazil, Argentina, and Uruguay, where American or Italian sulphur cannot now compete on account of the war. The sulphur deposits of Texas and Louisiana, aided by the wonderfully efficient and low-cost Frasch process, are competitors truly to be feared.

Future of Strategic Metal Production

The United States will have to come to Chile and Brazil in the future for the higher grade iron ores, which are being exhausted in North America at a rapid rate. This country is plentifully supplied with high-grade, good-quality, magmatic segregation magnetite-hematite iron deposits of the type of El Tofo and Romeral already mentioned. These are well situated near the sea in a south-north belt that extends from Coquimbo to Copiapó, and all of them are closely related to the granodiorite intrusions so common along the Coast Range. The most important are the Algarrobo (said to contain 200,000,000 tons of 60 percent ore), Ojos de Agua, Chañar Quemado, Cristales, Juan Soldado, Zapallo, Maitencillo, and Dorado.

Chile is not plentifully supplied with what might be termed the scarcer strategic minerals, scarce in comparison with iron, copper, nitrate, and manganese, with which we are liberally endowed. Tin has been authentically found only in narrow stringers in Antofagasta, near the Argentine border and at 19,000 ft. altitude. The deposit has no commercial importance, and it is unlikely that tin will be found in Chile, as the geological formations and conditions that make tin ore are absent. The same can be said for those

Slimes leaching plant of Andes Copper Co., Potrerillos, Chile

metals like chromium, nickel, and platinum, which are found in very basic rocks, so far as known practically nonexistent in Chile.

Molybdenum is being recovered by flotation at the Braden mill. An interesting deposit similar to the deposits of Argelia has been found about 20 miles out of Santiago and is being developed, about 5,000 tons of 0.7 percent molybdenite having been proved. The deposit contains also cupro-scheelite. An interesting old cobalt mine has been reopened near Freirina, but the ore is difficult to concentrate, being mostly erithrite, and the grade not sufficiently high for export. Before the outbreak of war, Japanese merchants were buying 1 percent cobalt ore for export to their country. Cobalt has also been recently discovered at the Mercedítas copper mine, near Santiago.

Commercial ores of vanadium, tungsten, and antimony have not been found. Recently what is claimed on reliable information to be great high-grade lead-zinc orebodies have been found in the lake region of southern Chile (Aysen province) near the Argentine border. Transportation will be a serious problem in the development of this property.

Though the northern half of the country from Arica to Talca is not likely to contain many new and large orebodies, because it has been well and consistently prospected, the southern half from Talca to the Strait of Magellan presents splendid opportunities for the finding of new ore deposits. The reason is to be found in the climate, for though northern Chile is very dry and practically devoid of vegetation and woods, the southern half is exceedingly rainy and covered with thick agricultural soil and many woods and forests. As a consequence, very few mines have been discovered and there are practically no miners and prospectors. There is no reason why the southern half of Chile should not be as rich in mineral wealth as the northern part, because geologically both halves are similar. But prospecting here will be far more difficult, and, therefore, attention should be paid to the newer systems of prospecting. The work would have to be properly organized in parties under the direction of young but relatively experienced engineers and geologists and not left entirely in the hands of the individual prospector.

This short and concise outline of the present status of the mining industry of Chile and of the known but undeveloped mineral resources proves that what is needed above all is capital to increase the mineral production of the country. Whether it is for drilling the low-grade oxidized deposits; finding a suitable process and building the reduction works in the case of copper; doing consistent research work until the difficult metallurgical riddle of turning out crude sulphur in large quantities and at low cost from the volcanic sulphur ores is solved; building new roads and improving the existing ones; bettering loading facilities at some of the ports; constructing new flotation and cyanide mills, or for other related reasons, the whole question turns on the one point of having the necessary capital to do the work. In this respect I might quote Napoleon on the three essentials required to wage war: money, money, and money. Having the capital and the ore deposits—which are here—everything else can be had or imported provided the necessary priorities are secured.

Because capital is what is required to develop new deposits and decrease costs in the known ones, and as such capital does not exist in Chile, it is obvious that it must be drawn from outside. Europe is bound to come out of this war with her financial resources strained to the breaking point; and as the rest of the Latin American countries are just as short of capital as Chile is, the inference is obvious that the only possible source of foreign capital is Uncle Sam.

Pertinent Data on Mining

For the information and guidance of mining capital, I give the salient features of the Chilean Mining Code, as follows:

In Chile the State is the sole owner of all mineral lands and mines, but grants claims to private individuals.

All substances, metallic or nonmetallic, can be denounced and are conceded judicially, coal excepted, which is ceded by the Executive.

Petroleum, guano, nitrates, and iodine are reserved to the State.

The Chilean Mining Code establishes and protects all grants or concessions for prospecting.

Mining claims are legally established through two proceedings; the filing of the claim and the survey of same.

Claims are held by the payment of a fixed yearly sum known as patent, excepting coal claims, which are maintained by labor.

In the office of the Notary for Mines are inscribed all acts and contracts relating to the claims and mining companies which are regulated by the Mining Code.

What can Chile do to attract that capital? In the first place, assure it that the return of the principal will be absolutely certain—barring of course, the contingencies and risks that are peculiar to mining the world over—together with a fair interest; and that Americans and American property will be protected just as much as Chileans and Chilean property will be and have been protected in the past.

How has Chile in the past fulfilled her obligations to foreign capital? I think nobody will dispute that fairly, for I cannot recollect that any responsible person has suggested seriously the confiscation of foreign property. A certain amount of resentment has been voiced recently with regard to the new tax on copper just enacted by Congress, but such tax must be regarded as a war measure. American capital was not justified in expecting to get all the benefit of the high price of copper during wartime, when taxes in the United States have been increased considerably; when it had been deriving an indirect but considerable benefit from our debased currency during the period when prices and wages were very low in terms of dollars; when there had been discrimination in price against South American copper; and, lastly, when maximum output was lowering costs and depleting the mines of the country at a much greater rate.

What is the outlook for foreign capital in the future?

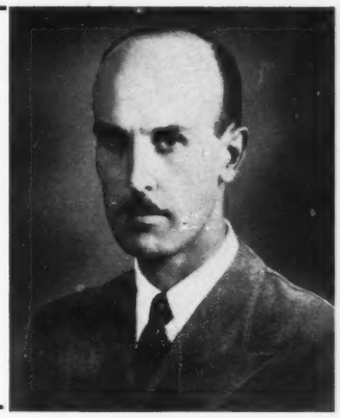
I think I cannot do better than to quote the opinion of our new President, Señor Juan Antonio Rios, made on the day when he took oath as President of Chile and published in the *Mercurio* of Santiago:

"It is indispensable to assure to both national and foreign capital those conditions of peace and order necessary for prosperity, besides protection, and to guarantee them that they will be identically considered as regards obtaining the benefits which are their due. The President considers that it is necessary to demonstrate that the foreign capital that will be invested in Chile will have splendid opportunities and absolute certainty to be protected in its legitimate endeavors; and to this effect the President has studied certain modifications in the law which created the Exchange Control Commission tending to facilitate the return of interest and other facilities. The situation of the world is extremely favorable to the investment in Chile of foreign capital, where it shall have very good opportunities to obtain profits and to help in the development of the country."

The last few years have seen a remarkable turn for the better in the foreign relations between the United States and her Latin American sisters. This is due, without a doubt, to the farsighted and just good neighbor policy of Mr. Roosevelt and his Secretary of State, Mr. Hull, as compared with the big-stick policy. The Pan American Conferences of Lima, Havana, and Río have drawn all the nations of this American continent much nearer to one another, both spiritually and economically, and though much remains to be done, there is hope everywhere that, at least in the New World discovered by Columbus, government of the people, by the people, and for the people shall not perish from the earth, as Lincoln said at Gettysburg, and Bolívar, San Martín, and O'Higgins had hoped for and fought bravely to achieve before him.

PERU

Opportunities await technically trained personnel in the development of a varied mineral industry



Carlos del Solar

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FOR the past several years Peru has been the world's largest producer of vanadium and bismuth, fourth largest of silver, and tenth of copper. Besides, its mines have yielded sizable amounts of lead, gold, zinc, tungsten, molybdenum, and antimony, and small quantities of mercury, sulphur, tin, and mica.

Going back to the beginning of the mining industry, it is certain that for many centuries the Pre-Incas and the Incas worked placer and lode gold, which accounted not only for the luxurious wealth of the Nazoa, Chimu, and Inca Empires, but also excited the greed of the sixteenth century Spanish conquerors, who, led by Francisco Pizarro, invaded the region in search of the "mountains where gold and silver lie in reach of any hand that wishes to possess it." The silver came from many a mine that is now in full modern production, especially in the Central and Southern Andes. It is quite common to find nowadays the copper tools employed by the Incas for their mining operations. These tools were hardened by some special process, and must have been quite efficient, considering the times. The Spaniards had a marked improvement on these tools, employing iron drill bars, about two inches in diameter, and using black powder for blasting.

The Conquistadores proceeded to extract as much gold and silver as conditions allowed. It is absolutely impossible to estimate how much, but some of the placer deposits show unmistakable signs of intense work. The method usually employed for recovering gold was by means of "cochas," a process still in vogue in some remote regions of the country. The work consisted in weakening the terraces by means of accumulation of water on the upper sections, and the opening of small tunnels. The material that eventually came down in landslides was passed through primitive sluices.

Then, of course, the still prevalent legend of Potosi, in Bolivia, was based on the enormous silver wealth of that highland republic, and resulted in very intense development and exploitation during the Spanish colonial period.

Cerro de Pasco, Morococha, and adjoining fields show signs of intense mining by the Spaniards. These workings were mostly "medias barretas," or small shafts following the veins in depth, and although the volume extracted is rather negligible compared with present-day mining, it covered a good part of the viceregal budget, which, including the large share extracted by the Spanish Crown, was no small morsel.

The Castrovirreina region, which was so named because the town was founded by the wife of Viceroy Castro, produced in those days large amounts of silver, mainly from extremely rich bonanzas of proustite ore. Even some fifty years ago, Santa Ines mine, the richest in that area, produced enough silver to form the fortunes of many rich families.

In Huancavelica, just behind that town, the Santa Barbara mercury

mine, which is now being prepared for intense exploitation, made Amador de Cabrera so wealthy that he amassed more riches than the original and powerful Conquistadores. The legend of the discovery of Santa Barbara states that, during a Corpus Christi procession in the town of Huancavelica, Cabrera trusted his hat, which had a band of diamonds and precious stones, to the son of Nahuincopace, a powerful Indian chief. The boy lost the hat, and since Cabrera dropped the affair as trivial, Nahuincopace, in payment of his kindness, showed him the splendid outcrops of Santa Barbara.

In a word there is not a single region in all Peru that has not been worked more or less intensely by the Spaniards, in search of ores containing silver and gold. It was only natural that, with the few thousand Indian workers each conquistador had freely assigned to him, so many worthless deposits as well as some valuable ones could be worked.

The mining industry, as a whole, has been steadily increasing in importance, so that in 1941 Peru had a mineral production of $38,000,000, exclusive of petroleum, which was valued at about $12,000,000. The former figure closely approximates the national budget. It is of course important to mention that the foreign ownership of the larger mining concerns results in the exportation to foreign countries not only of the ores and metals, but also of the money derived therefrom. Hence, the larger proportion of silver, copper, vanadium, bismuth, tin, zinc, and to a lesser degree gold, is produced by foreign concerns.

Banco Minero del Peru—Among the many activities of the government designed to aid the mining industry, none has been of such magnitude as the establishment of the Banco Minero del Peru. This bank, strictly limited to mining, was founded by a special law of Congress, is totally owned by the State, and receives its income from a special export tax on ores. Its object is to aid financially in the development of mining properties with at least 60 percent Peruvian capital; to study the many mining regions in Peru, with a view to establishing custom mills and

branch offices for the assaying and buying of ores; and to provide the mining industry with the materials it needs at the lowest possible cost. Although the Banco has been in operation only one year, it has already financed many mines, has one custom mill (in Castrovirreina), and is aiding the mining industry at this very difficult time in the purchase of the materials it requires and in the sale and shipment of its products. The Banco is contemplating the installation of several flotation custom mills at regions now being studied.

Copper—Peru produced in 1941, 35,378 tons of copper, with a gross value of $8,478,000. Of this production, about 80 percent was produced by the Cerro de Pasco Copper Corp. from its properties at Morococha, Cerro de Pasco, Casapalca, and San Cristobal. The rest came from small mines belonging mostly to Peruvians.

The immediate future of copper is very bright, and lies in the development of new mines by the Cerro de Pasco Copper Corp. In Yuaricocha, near Oroya, Cerro had spent up to last year $100,000 developing the property, and is now studying the possibilities of building a branch railroad that will join the Oroya-Huancayo main line in order to start exploitation as soon as possible. The installation of an aerial tram from the end of this branch has also been contemplated. Up to last year Cerro had 1,000,000 tons of ore in sight, containing 7.4 percent copper, 5 oz. silver and 0.09 oz. gold per ton.

Another interesting possibility is Toquepala and adjoining areas, near Moquegua, in Southern Peru. Cerro has been working on the property for at least two years, but little is known of the results obtained. The deposits are of the Chuquicamata type, with large stocks of low-grade copper ore, easily extractable by open cut operations. Naturally any exploitation of that area will be undertaken on a very large scale.

Lead and Zinc—In 1941 Peru produced 54,821 tons of lead, valued at $6,986,000, and 24,358 tons of zinc, with a gross value of $2,045,000. The greatest part of this production came from the Cerro de Pasco Copper Corp. mines, and also from concentrates and ores that were sold to the company's smelter at Oroya. About 70 percent of Peru's lead is produced electrolytically, almost entirely for export purposes. The remaining 30 percent is exported as concentrate. Of the zinc, 75 percent is produced by the Cerro de Pasco Copper Corp. and most of the rest by Anglo-French Ticapampa, in the Department of Ancash. All of the zinc produced in Peru is really a byproduct, since there are no mines devoted specially to its exploitation, the metal being extracted during the process of treating lead and silver ores. Cerro has a pilot electrolytic plant, which produced last year 708 tons of zinc. A larger plant is contemplated. All zinc is exported. The possibilities of expanding the production of lead and zinc in Peru are really large. It is difficult to find any large area that does not contain some lead, zinc, and silver; on the other hand, the higher price of zinc concentrates has caused the establishment of additional flotation units in plants now in operation.

Vanadium—Production of vanadium is and has always been in the hands of one company, The Vanadium Corporation of America, which produced and exported 1,816 tons in 1941, with a gross value of $1,101,000. The Minas Ragra zone, belonging to this company, is the only large known vanadium area in Peru, although there are in the Yauli region many asphaltites which contain small amounts of that metal. As to reserves, Vanadium Corporation has a large tonnage of low-grade ore, having already extracted a large percentage of its high grade.

Molybdenum—There is only one company, Peru Molibdeno, S. A., which produces molybdenum to any extent (over 90 percent of the total). In 1941 Peru produced 245.5 tons of molybdenite in concentrates, valued at $244,000. There are several prospects in Peru for the expansion of the industry, but by far the largest possibilities are in the Janchiscocha area, near Jauja, owned by Peru Molibdeno, S.A.

Tungsten—Not much tungsten is produced in Peru, although since the Sino-Japanese war, considerable expansion has taken place. In 1941, Peru produced 202.2 tons of tungsten concentrates (WO_3 content), with a gross value of $535,000. All of the production came from the Ancash and La Libertad regions, where small disseminated quartz lenses carry wolframite and other tungsten minerals, and are worked by hand picking and concentrated in hand-operated jigs. The possibilities of expanding the industry depend on the number of men working the deposits rather than in the development of new properties, since only this type of deposit has been found in Peru.

Antimony—All of the 1,569 tons of antimony produced in Peru in 1941

Custom flotation mill operated by Banco Minero del Peru near Castrovirreina. Elevation, 15,150 ft.

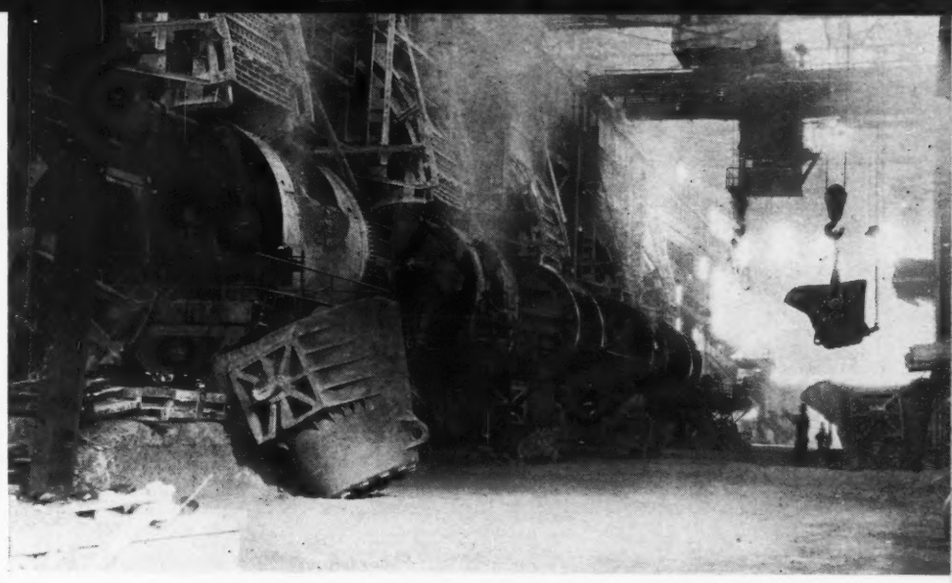
Mill at Huachon, showing highway, hydroelectric plant, and mule trails

came from the hand picking and jigging of high-grade ores. This production is valued at $312,000 and represents the efforts of many small miners spread all over the country. The most important mines are in Puno and La Libertad. The Puno deposits are large, but need development, and are at present producing a small fraction of their capacity.

Silver—Peru is the world's fourth largest producer of silver. In 1941 it produced 15,030,400 oz. valued at $5,250,000. About 60 percent of this represents a byproduct of lead and copper ores; hence the production of silver is in direct proportion to the extraction of lead, copper, and zinc ores, and its possibilities for the immediate future are rather good because of the large demand for the production of essential metals. Silver is widely spread, and in most cases represents the basis of small enterprises. Undoubtedly, a decrease in the price of silver would bring about in Peru an immediate decline in the production of copper, lead, and zinc.

Gold—The value of gold production in Peru in 1941 was approximately 24 percent of the total mineral production. It amounted to 252,458 oz. with a gross value of $8,836,000. Of this gold, about 30 percent is a byproduct of the copper, lead, and zinc industries. The rest, 70 percent, comes from properties which produce only gold, and which belong to companies owned by Peruvian and American capital. Hence the extraction of gold in Peru is the only important mining industry which can be considered nationally owned. It employs about 9,000 men, or about 33 percent of the total mining laborers, is financed by the purchase of company shares by widespread middle classes who have thus invested some of their savings, and is geographically in such a position (the only type of mining developed in the coastal region) that its importance in the development and progress of the country is obvious. In the regions where gold is produced, there are no other minerals of economic importance, and therefore the people of those regions depend entirely on this industry for their support and welfare. The present situation concerning priorities has so far not affected deeply the gold industry in Peru. Except for placer mining, which produces only about 9 percent of the total, and which needs practically no materials for the continuance of the activities, the gold industry now is finding it difficult to obtain the necessary priorities for the procurement of its needs.

Mica—The mica industry is the youngest mining enterprise in Peru. There has been a very strong demand for this product in the last two years, resulting in the prospecting of areas which were known to contain fair amounts of mica. The production in 1941 amounted to 7½ tons, with a gross value of $2,000. Practically all came from small pegmatite dikes in the vicinity of Quilca and Camana, in Southern Peru. Expansion of the industry depends largely on amount of investment in prospecting and developing these areas.



Converter line at smelter of Cerro de Pasco Copper Corp., Oroya, Peru

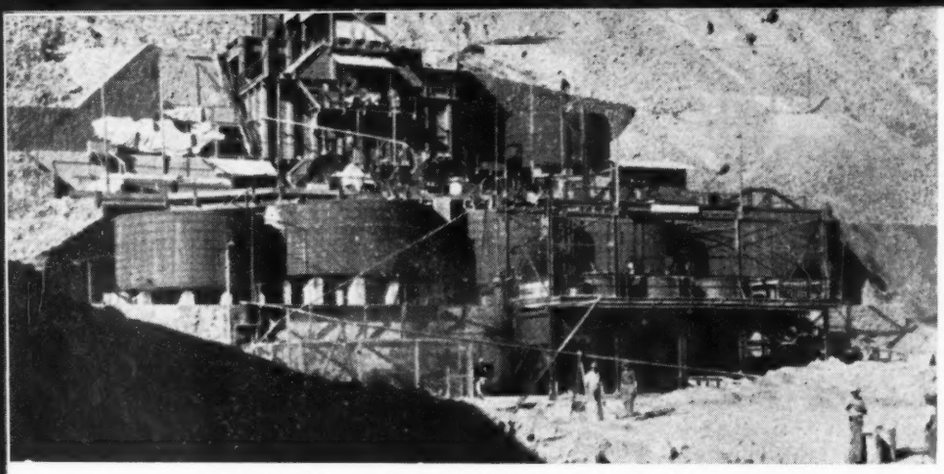
Bismuth—The Cerro de Pasco smelter produced 520 tons of bismuth in 1941, valued at $1,433,000. Most of the ore came from San Gregorio mine, owned by Eulogio Fernandini. All this bismuth is precipitated from fumes of the Oroya smelter and represents Peru's only source of this metal.

Coal—In 1941 Peru produced 195,000 tons of coal, with a gross value of $300,000, mostly for local consumption. The greater part is used by Cerro de Pasco Copper Corp. in its Oroya smelter, and comes from the Goyllarisquizga area, owned by Cerro. Some is exported to Argentina, from the Ancash region. Because of the scarcity of shipping space these last two years and the consequent lack of British and American coal, a critical situation has developed in Argentina. Extensive development is expected, but limited in turn to the facilities of shipping.

Undeveloped Mineral Resources—Although the mining of the important metals in Peru has not been developed in its limits, the probability of finding large deposits of copper, zinc, lead, and silver is still favorable. However, no new large deposits of these ores, with exception perhaps of the Toquepala and Yuaricocha copper properties and the Huachocopla lead and zinc areas, are known well enough to warrant an opinion on the possibilities for the near future.

Iron—There is one large iron deposit in Peru, the Marcona area, and several small prospects are known. Marcona, located south of Ica, in Southern Peru, has been prospected quite thoroughly in the last few years. The Peruvian government studied the region some fifteen years ago, diamond-drilling the large hematite and magnetite stocks and proving several million tons of ore containing over 60 percent iron. The Brassert company also studied the deposit, prospecting with diamond drill and checking the results obtained by the previous investigation, with a view to the establishment of a steel industry in Peru. This same concern studied the Yuarilla area, a small iron deposit east of Ica, as well as Tambo Grande, east of Piura, in Northern Peru. These two areas are of little importance. The establishment of the steel industry, a fervent hope of the government, is still under consideration, although present conditions have delayed for a time the carrying out of this project. Unquestionably Marcona is a large iron deposit which can easily produce the necessary amount and quality of ore required for an iron industry, which, in the case of Peru, would naturally be at first on a limited scale.

Gold—The possibilities of developing any large deposits of gold at this time are rather remote, but the resources of Peru warrant the hope that in peacetime a great deal will be done in this field. Although the greater proportion of gold mining in Peru has been carried out on the coastal plains, these mines are really small, and offer few possibilities for large-scale operations. The real gold future of Peru is in the Montana, or jungle region, east of the Andean ranges, where most rivers carry gold in commercial quantities, and where there exist a considerable number of terraces that were worked extensively and profitably by the colonial Spaniards, and which still contain large volumes of gold-bearing gravels. I personally studied a terrace in Sandia, where the Spaniards worked over 50 million cubic yards, and where there is still left 25 million yards which will run at least 30c. gold per yard. In the Montana, however, the main difficulties for the development of its gold resources lie in the lack of transportation facilities and the large investments required. There are, however, many prospects which



Cyanide mill near Calpa, Peru, on the coast. Absolute lack of rain makes roofs unnecessary

could be worked profitably on a small scale.

Mercury—The Huancavelica region offers favorable possibilities for the development of mercury mines. The most important area is in Santa Barbara, where intense exploration and development is now being carried on. There are several small prospects working richer ore in that area, but the production of mercury so far has been negligible.

Molybdenum—In the vicinity of Janchiscocha properties, belonging to Peru Molibdeno, S.A., the Tacarpan and Siete Amigos areas present excellent possibilities for the development of molybdenum ore. In these areas, there are several large quartz veins carrying an average of 1 percent molybdenite which justify the investment of capital in development, since the ore is known to be easily treated by flotation and is free from copper and other deleterious substances.

Nickel—In Cerro Rapi, in the Department of Ayacucho, there are several veins containing variable amounts of nickel. The area is large but undeveloped, and little is known as to its possibilities.

Mechanical Equipment and Transport—With the exception of the very small mines, those that merely handpick high-grade ores and either export them or sell them to the smelter at Oroya, all the most important mines in Peru have good mechanical equipment.

Machinery is mostly imported from the United States, although before the war some of European manufacture was installed because of its considerably lower price. These mines have concentration plants which either float or cyanide their ores, and are up to date in all respects. As far as drilling is concerned, most of it is done by modern machinery, although every mine has a crew of hand drillers which is constantly doing exploration work in neighboring areas that cannot be reached by the compressors. Also, because of the low cost of labor, some hand drilling is always done generally within the mines themselves. Mechanical shovels are little used because of the high cost involved in their purchase, compared to the small cost of the laborer. The average mine laborer earns about $0.30 a day.

Although Peru has a very steep topography and the opportunities for developing hydroelectric power are very favorable, little has been done in this field. With the exception of Cerro de Pasco, which has several hydroelectric plants, and sells power in the neighborhood of Oroya, Cerro, and Morococha, there are no other plants that offer these facilities. In fact, all the other hydroelectric plants are either Pelton wheels or small turbines, which merely fill the individual needs of each mine. The reason for this lack of power facilities lies in the lack of the large capital necessary for these enterprises, and in the topography of the country, which makes it difficult for power lines to be laid across a rugged land and over long distances.

Furthermore, since in the Sierras most mines are in the upper highlands, and have in their vicinity rivers which are still being formed and carry little water, they find it necessary to resort to the use of diesel engines, which, although oil is very cheap in Peru ($6 a ton in Lima), have a high cost of operation. In the coastal plain the same difficulty arises, since most mines are located away from the valleys.

Road building in Peru has been pushed ahead considerably in the last ten years, but, the country being rather large and difficult in its topography, a great deal is still to be done. Most of the roads have been built by the government, and the only exceptions are some small branches of little importance. Mechanical equipment is used extensively by the government, but none is employed by private road builders, since the low cost of labor easily counterbalances the high cost of the machinery.

The coastal roads of Peru are probably the best in South and Central America. The frequently mentioned Pan-American Highway has been completed in Peru, and is asphalted about 70 percent of its length. The rest of the road is well cemented gravel, and heavy loads travel constantly over it.

In the Sierras, road building has also progressed a great deal. The Carretera Central, which goes from Lima to Oroya, and then to Cerro de Pasco and Huanuco on the north and Castrovirreina on the south, is asphalted as far as Oroya, and in fine condition the rest of the way. There are several other roads that go into the Andean regions, and a few that go into the jungle region. The most important of the latter, the Pucalpa Highway, which goes from Huanuco to Pucalpa, on the navigable section of the Ucayali River, is nearing completion, and will facilitate the transportation of many important products from and to the Montana.

A great deal of the transportation of mining equipment has been done in Peru by means of airplanes. Parcoy, one of the largest gold mines, used planes almost exclusively to carry in its large cyanidation plant; Cotabambas, in Apurimac, another large gold mine, employed tri-motored Ford planes to carry in its heavy machinery.

Technically Trained Personnel—Although Peru has a fine school of mines, and although many skillful mining engineers have been trained here, the need for specialized training is being felt strongly. In the past few years, training in flotation, cyanidation, geology, paleontology, petrography, and the technical subjects, has taken a long step ahead; however, the training is not sufficiently specialized to fill the needs for expert men in each of these fields. Besides, the school does not graduate enough men to fill the needs of the mining industry, and the country finds itself with a shortage of mining engineers and trained personnel in general.

Trained labor, however, is easily found, since the highland Peruvians are essentially mining men and have rapidly assimilated mining operations. They are well adapted to the altitudes, and have a high percentage of efficiency.

In the past three years a very strong current of cultural interchange with the United States has been felt in Peru. Since seasons are inverted, many American students have been coming to Peru in June, in order to take a few cultural courses at the University of San Marcos, which, by the way, is the oldest in the Western Hemisphere. Most of these students take literary and historical courses, but there are some who dedicate their time to scientific activities, including mining. The current works both ways, and many Peruvian students have also been taking their vacations, from December to April, in the United States, studying at many American universities. This interchange of knowledge is likely to be of great advantage to Peru, as the country is being looked at more closely by Americans and Peruvians are also

getting an opportunity of visiting the United States.

Specifically in the engineering field, several American firms in Peru have established scholarships for prominent Peruvian students. The winners of these scholarships get several years in the United States studying mining, flotation, and related subjects. At present there are several men in the States, and the results are very promising.

Capital—Mine development in Peru depends finally and exclusively on capital. In the past ten years Peruvian capital has flowed in comparatively large amounts into the mining industry, especially in the formation of companies concerned with gold mining. In this field the industry has been successful in safeguarding the interests of the investors. Basic metals also have attracted the attention of capital, and several companies have been established for the production of lead, zinc, and silver, although this field is largely in the hands of foreign concerns. Even in gold, hardly any work has been done in the Montana, which offers the best possibilities for large investment.

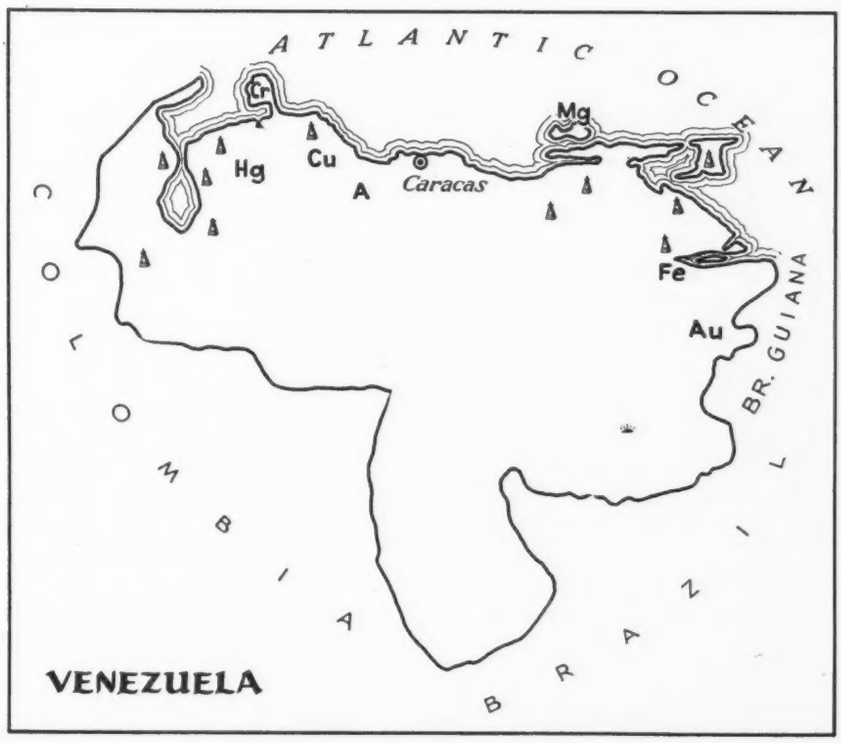
I believe that the chances for the investment of large capital in mining are very favorable, as the country has splendid prospects for the development of mines and their operation.

Mining Laws—Without exaggeration, it may be said that there are few countries which offer greater facilities to the mining industry than Peru. For the acquisition of claims, or for any other mining activity, the law does not differentiate between Peruvians and foreigners. The only exception concerns all mining properties located within 25 miles of a foreign border: these can be owned only by nationals. Claims for all metals except gold are divided into pertenencias (100x200 meters), 60 pertenencias being the maximum for one single claim, although one person may acquire several claims at once. For coal the tariff is the same, but the pertenencia is 200x200 meters. Tariff is about $0.20 per pertenencia for a 60-pertenencia claim. Tax for holding the property amounts to about $5 per pertenencia per year.

For gold there are two different types of concessions: for exploration and for exploitation. The former is valid only for four years, the tax being 1½c. per hectare (100x100 meters) for the claim, and proof that the concession has been undergoing exploration after the concession is granted. This type of concession has to be converted into an exploitation concession after the two-year period. In this condition the concession has to pay a tax of 7½c. a year per hectare if lode mining, and half as much if a placer. Besides there is a royalty on the gold production of 5 percent from the operation of placers, and 4 percent from that of lode mines.

VENEZUELA

Iron, asbestos and other minerals will supplement petroleum and gold in national mineral economy



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VENEZUELAN ECONOMY as developments of the last few months have emphasized, is largely dependent on that of the United States. Four principal factors control the production, consumption, and distribution of goods in Venezuela. They are: first, conditions of transportation to and from the United States; second, control exercised by the United States on its exports and production of goods for export; third, limitations imposed by the United States on import of Venezuelan goods; and fourth, the exchange situation between the two countries.

Shipping between northern South America and the United States has been for many years in American and Dutch hands. As a result, when events

Mine of El Tigre Asbestos Co., Tinaquillo, Venezuela, an important new producer

at Pearl Harbor caused the Shipping Board to redistribute shipping, one of the first to suffer was Venezuela; the luxury cruise vessels with ample cargo space operating on regular schedules have been replaced by smaller steamers which appear unannounced. Furthermore, enemy action has been concentrated on the great tanker fleet which takes Venezuela's oil to the production lines of the United Nations, a blow which threatens vital oil supplies and strikes at the foundation of this country's financial and economic structure. Means must be found to insure an uninterrupted flow of oil to market.

In short, then, the United States, by its control of shipping space alone, can encourage or throttle any mining enterprise in Venezuela. This power over transportation has replaced the old tariffs as a means of limiting United States imports from South America. It is an even more direct means of control, for, if the shipping space is denied, no amount of cutting costs can ever get the product to market.

It is clear that any mining company not working exclusively by hand is dependent on supplies from North America; and the United States government, through priority allocation of such supplies, has almost complete control of any enterprise, even though its product be marketed internally. Obviously this power will be used to stimulate only the production of those materials needed by war industry. This situation, though well understood in South America, gives poor comfort to the folk of such a region as the State of Bolivar, which at present is almost entirely dependent on gold mining. Considerable dissatisfaction will result, and efforts should be made to direct any grumbling against the authors of the war rather than against the United States.

Under the circumstances the United States government bureaus responsible for the control of mineral (and other) products in Latin America must study in great detail the economic structures of each nation in order to avoid causing damage which might later give rise to serious repercussions. The United States has assumed in large part the responsibility for the mineral economy of Latin America and will be held accountable for it. Thorough and objective study is required, not only of the mining industry itself but of the relationships between it and the national economy of each nation.

Venezuela's economy is not too complex. Petroleum, agriculture, and, to a lesser extent, gold mining create the purchasing power which, in turn, supports commerce and pays the taxes. Any change in the oil or gold mining payrolls is reflected immediately in national conditions. The petroleum situation for the last few years can best be described as a waning boom, but for a time a great impulse was given to housing, public works, and utilities, though only lately have these services been expanded to meet the needs. For example, until a few months ago, almost all investment was funneled into real estate, especially in Caracas, but by now the town is built up to its population of 300,000 and capital can begin to find its way into manufacturing and mining. The exact quantity of capital available is impossible to determine but it is at least ample for small enterprises.

Mineral Production

Gold—In 1941, 4,056,314 grams of gold was produced; of this 3,294,091 grams (105,909.7 oz.) came from the New Goldfields mines, at El Callao. These properties milled 230,696 tons of ore, extracting 9.182 dwt. per ton. The remainder of the concessions, including the French Mocupia mining company, produced 625,361 grams, and individual panners turned in 136,862 grams. This latter figure is considerably below the corresponding amount for former years, because so many prospectors have abandoned the goldfields for the diamond placers of the Surukun River in the Great Savannah. Diamond production has risen correspondingly.

High costs, caused by difficult transportation, and the disadvantages of working in a boom economy make it improbable that gold production will increase in the near future. Although new mineralized regions may be discovered, and completion of the new road from Ciudad Bolivar to El Callao will lower transportation charges, no great permanent expansion of gold mining can be expected unless wages fall or gold again rises in price.

Cement—Venezuela keeps two cement plants operating, one at Caracas and the other at Valencia, about 60 miles west. These plants, however, do not supply the country's needs, and two new installations are projected. One is to supply the western part of the country, Maracaibo and the Andes; the other will be located in the east.

Diamonds—Diamonds are washed from river gravels by individuals or small groups of miners, and two fields are active at present—the Rio Pao field (not to be confused with the iron mine of the same name), which is on one of the western tributaries of the Caroni River, and the Surukun placers, which lie deep in the Great Savannah. Production from the former is dropping, but it is more than compensated by the latter's output. The Surukun became active in 1931, and produced in 1941, 22,931 carats—twice as much as in 1940. Total production for 1941 over the whole country was 29,399 carats. Prices paid at the mine for the Surukun diamonds run as follows:

Carats	Bs per Carat
0.49	34.50
0.50-0.99	69.00
1.00-1.49	103.50
1.50-1.99	126.50
2.00-2.99	172.50

(The current exchange, May, 1942, Bs 3.40=$1.00)

Of course, as in the case of freely mined placer gold, little equipment or capital is involved and diamond production may suffer sharp changes at short notice. Because Venezuela is not primarily a mining country, and because immigration is restricted, the number of Venezuelan prospectors willing to live and work in stream channels is definitely limited. Therefore, we can expect increased diamond production only at the expense of placer gold mining, or if new rich deposits are discovered and larger scale methods introduced. In considering the latter possibility, it must be remembered that the Surukun is one of the most inaccessible mining regions in the world.

Mineral Resources

Iron, asbestos, and magnesite are the principal mineral resources now under development; mercury and chromite have also received some attention.

Iron—The metamorphic rocks of the Guiana lobe of the Brazilian Shield

contain extensive beds of ferruginous quartzites. In the Imataca Range, a series of hills east of Ciudad Bolivar and south of the Orinoco River, these quartzites are very well developed. They differ from the Brazilian iron formations in their hardness, coarse texture, and content of magnetite developed secondarily after hematite, the principal constituent of the rock. Although the immense tonnage of iron ore available in the formations has never been measured, at several locations some exploration and development work has been accomplished.

El Pao, the most important of these, is a concession belonging to a subsidiary of the Bethlehem Steel Corp. The deposit has been drilled and over 60,000,000 tons of ore better than 65 percent in grade has been reported. At present, the property and Palua, on the Orinoco River 50 km. away, are being connected by a road which will be followed by a railroad as rapidly as possible. At Palua, about 1½ miles from the town of San Felix, a harbor is being constructed with rapid loading facilities and a bin of 220,000 tons' capacity. Plans call for an annual production of 800,000 to 1,000,000 tons. The ore is to be blasted down from benches, loaded by 8-ton electric shovels into 25-ton diesel trucks, and transported to primary and secondary crushers which will reduce the ore to 5 cm. in size. The crushed ore will be taken to the Palua bin in 70-ton cars connected in 30-car trains. An airfield and camps must be constructed and the Orinoco channels will have to be marked and maintained. Ships must be made available to take the ore from Palua to the furnaces in the United States for final treatment.

Asbestos—Closer to production, perhaps, than the Bethlehem company iron mine is the El Tigre asbestos company. This Venezuelan concern owns a large part of the Tinaquillo deposit about 100 miles west of Caracas. Here a great ultrabasic sill has invaded the schists and gneisses of the Venezuelan Coast Range. The sill consists of thin alternating bands of gabbro and peridotite; much of the peridotite is completely serpentinized. Chromite, picotite, and magnetite occur as accessory minerals. Magnesite, chalcedony —often of a peculiar apple-green color—and meerschaum occur in veinlets cutting the rocks. The asbestos is found principally in cross-fiber veinlets and is of excellent quality, similar in physical properties to the best Canadian fiber. Mr. Michael Messel, who was brought down from Canada to take charge of plant erection and opening of the mine, has completed drilling and reports an orebody of 3,000,000 tons containing 3 percent fiber of Grade 6D or higher. The plant is now 70 percent completed; it is designed to treat 960 tons daily and produce 6,000 tons of asbestos per year. The better grades will be exported to the United States and the shorter fibers used to make pipe and roofing for the local market. Priorities have already been obtained on the equipment, and it is hoped that operation will begin this year.

Magnesite—Although magnesite is known at Tinaquillo, it is only on the Island of Margarita that it occurs in commercial quantities. Here an intrusion similar to that at Tinaquillo contains several deposits of magnesite. By far the most important, both in richness of mineralization and stage of development, is the Loma de Guerra mine. The magnesite is found as a compact dull white mineral with a hackly fracture, and weathers to a powdery chalky substance. It occurs in a meshwork of veinlets, but can be mined only where a series of veins occur thickly enough to be broken from the matrix as clean mineral. Many deposits on the island contain a high percentage of magnesite, but in only a very few cases is it practical to clean the vein matter from the adhering serpentine. In this district the presence of small quantities of chromite in the ultrabasic rocks is notable; asbestos mineralization, however, has proved disappointing.

The Loma de Guerra is developed by three principal quarries, of which No. 2 has a face over 70 ft. high. The Industrial Mineral Co., owner of the property, has calculated that ore reserves exceed 6,000,000 tons of rock over 25 percent magnesite. The ore is remarkably free of both silica and iron. Recently an old railroad leading to the port of Manzanillo, a few miles away, where the company has a rotary kiln, was torn up to make way for a truck highway, and plans are being made to reopen the mines as soon as arrangements are completed for marketing and transporting the ore to the United States. The possible rate of production of the Loma de Guerra mine depends principally on the capacity of the equipment installed; five working faces could easily be established in the existing quarries.

Chromite—At present the only location where notable segregations of chromite are known is at Santa Ana, on the Peninsula of Paraguana, in western Venezuela. The general occurrence of this mineral in the widely distributed ultrabasic rocks of the Coast Range makes it probable that other deposits may some day come to light. The Paraguana deposit was drilled lately by the Venezuelan Geological Service. Examination proved it to contain approximately 5,000 tons of good-grade ore.

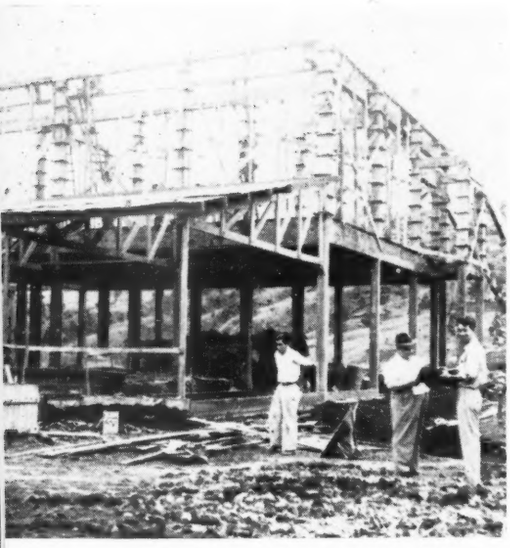
Mercury—Near Carora, the San Jacinto mine is beginning to produce some quicksilver. The property contains several 3-ft. beds of sandstone interbedded with a thick series of moderately dipping shales. The sandstone is irregularly mineralized with pyrite and cinnabar, but in depth it is reported, pyrite increases at the expense of the mercury sulphide. A ten-pipe

Mill of French Mocupia Mining Co., El Callao, Venezuela, a gold mining operation

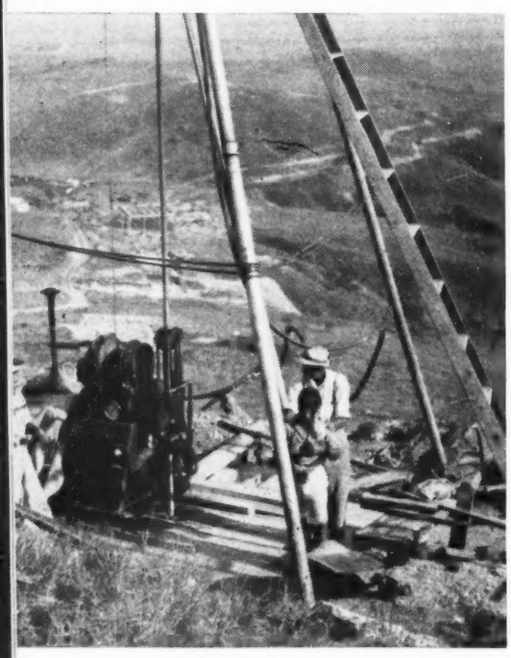
Loma de Guerra magnesite quarry on Margarita Island owned by Industrial Mineral Co.

retort has been constructed, and the difficulties caused by the high proportion of hydrocarbons are being overcome. It is expected that the mine will produce enough mercury to supply Venezuelan needs, with possibly some excess for export.

Copper—Recently the possibility of opening the old Aroa copper mine has been widely discussed. In a small, faulted anticline in the metamorphosed clay shales and limy shales southwest of Puerto Cabello, a limestone member has been locally replaced by pyrite, and the pyrite, in turn, by chalcopyrite. The sediments are underlain by granite. The mine has been operated since colonial times but was closed down in 1931 and is at present filled with water and partly caved. Its total production is said to have been over a million tons. In 1922 Charles H. Stewart estimated that 603,350 tons of ore running 5 percent copper remained developed in the main Aroa orebody, but subsequently 168,000 tons were removed containing only 3.5 percent metal. If Stewart's quantitative figures are correct, 435,000 tons of ore should still be left. When the mine was last operated, costs were estimated at 14c per pound of copper, but expenses could now be somewhat lowered because of the recent opening of a new railroad connecting the mine with Puerto Cabello.



Constructing new mill at El Tigre Asbestos Co., Tinaquillo. With a capacity of 960 tons per day, this property represents an important step in the expansion of locally owned mining enterprise



Diamond drilling at El Tigre mine indicates an orebody of about 3,000,000 tons containing 3 percent asbestos fiber of Grade 6D or higher. The better grades will be shipped to the United States

The outlook for the discovery of new deposits in Venezuela is not bad. Although the northern part of the country is quite well known and is rather poorly mineralized, the shield area south of the Orinoco River is little explored, and what is known of it shows promise.

Needs of the Venezuelan Mining Industry

The two principal gold mining companies report their necessities of priority material for one year's operation as follows:

Material	New Goldfields of Venezuela, Ltd., Tons	French Mocupia Mining Tons
Steel	650	90
Rubber	23	5.5
Chemicals	355	58
Carbide	121	9
Explosives	250	50

Venezuela's two operating cement plants require the material necessary for maintaining their output, but the two proposed plants will, of course, require complete quarrying and treating equipment.

El Pao iron mine possibly requires more equipment than the remainder of the industry combined; all steel, invested in order to be able to mine more iron. The Loma de Guerra magnesite mine would require two or three diesel shovels, earth-moving equipment, a small fleet of trucks, loading equipment at the port of Manzanillo, and shipping space to take the mineral to market. The Aroa copper mine still has the remains of a flotation plant installed by C. A. Heberlein before it was shut down, but much of it would have to be replaced and the mine would require complete modern mining equipment. El Tigre asbestos mine already has priorities on most of its equipment, and requires only shipping space and maintenance materials.

Venezuela has a good geological school—now graduating its first class—and has several nationals well trained abroad in mining technology. However, the school functions primarily to supply the petroleum industry, and the competent Venezuelans are for the most part in the employ of the government. The local mining industry must, therefore, depend entirely on the United States for its technical personnel. The supply of trained and untrained labor depends on the condition of the oil industry, which can easily absorb all the nation's skilled labor.

Opportunities for Capital

Capital, especially in larger enterprises, can be comparatively well employed in Venezuela. Taxes are low. A placer claim pays Bs 0.50 per hectare per year; claims may not exceed 1,500 hectares. Lode claims pay Bs 1.00 per hectare and may not exceed 500 hectares in area. A claim must be in operation (employ five men and some equipment) within three years on penalty of forfeit.

There is a production tax which varies in the following fashion with the value of the ore mined:

Value of Ore Mined	Tax Paid as Percentage of Gross, Per Cent
Bs 20.00 or less	0.00
20.00– 35.00	0.50
35.00– 50.00	0.75
50.00–100.00	1.00
100.00–200.00	1.25
200.00–300.00	1.50
300.00–400.00	1.75

The tax then increases 0.25 percent for every Bs 100.00 additional value of ore up to Bs 1000.00, which, together with all higher values, pays 4 percent. There is talk at present in Caracas of proposing an income-tax law, and it is hoped that if this law is passed the production tax will be removed. Nuisance charges for excise stamps, stamped paper, permits, and other official business may involve considerable expense and proper allowance is seldom made for them. In general, mining costs in Venezuela are very high. Labor receives a base pay of around $2.00 and, in addition, social benefits, which usually total about 20 per cent of the payroll. Timber and most other supplies, except oil, have to be imported from abroad but are allowed entry free of duty.

At present the industry is fortunate in having as officials responsible for it in the Venezuelan government, men who are both well trained and sincere in their efforts to aid the miner. For example, Dr. Carlos Delgado, Director of Mines, was educated in the United States, and for years after his return, he was mine warden at El Callao, the country's principal mining district. Few men in South America are as thoroughly conversant with the problems that confront an operating mining company, and few men understand as he does that the prosperity of the mining industry adds to the well-being of the nation.

BRAZIL

Exceptional reserves of iron, manganese, and nickel promise the development of a vast mineral industry

Emilio Alves Teixeira

Engineer and Geologist, Departamento Nacional da Producao Mineral, Rio de Janeiro

IF WE LOOK BACK and compare the present status of the mining industry in Brazil with what it used to be 15 years ago, we note that the development achieved is really outstanding. Three factors have contributed to the growth of the industry —namely, the wealth of the country's mineral resources, the growing need of industry for raw material, and the great government interest in encouraging development and exploitation of ore deposits. The National Department of Mineral Production, under the Ministry of Agriculture, has been active in investigating mineral deposits and furnishing to the public information regarding them. The time is ripe for an increasing investment in mining, and we hope that the next few years will provide a more stable base on which to build the industry.

Present Status—The principal minerals under present exploitation are iron, gold, manganese, coal, rock crystal, mica, diamond, zirconium, and bauxite. Gold and coal are of importance only to Brazil, but the others are exported as strategic minerals.

Iron—Iron constitutes Brazil's biggest and richest mineral reserve. No other country in the world possesses extensive deposits of such particularly high grade. The most outstanding center of iron-ore reserves is the State of Minas Geraes, in its central part. Other states like Bahia, S. Paulo, Goyaz, Matto Grosso, Parana, and Santa Catharina have their deposits, but by far less important than those of Minas Geraes, and no new districts have been discovered in the past 20 years.

Estimates of Brazil's iron resources are based on rather incomplete data, for few deposits have been properly prospected, but a figure of 15,000,000,000 tons may not be exaggerated when one takes into consideration the immense amount of lower-grade ore available. A safe estimate of high-grade ore in Minas Geraes alone will reach 1,500,000,000 tons. High-grade itabirite, canga, and other ores running from 50 to 60 percent probably account for 4,000,000,000 tons; the remaining 9,500,000,00 tons are of low-grade material below 50 percent.

Minas Geraes' deposits of iron ore are in the central part of the State in the headwaters of the S. Francisco and Doce rivers. This is the largest area of schist formation in Brazil, and the rocks forming it (phyllite, quartzite, itabirite, dolomite, itacolomite) are related to the Minas Series, of Algonkean age. Three main districts may be recognized, namely: Itabira, on the Rio Doce valley; Itabirito; and Paraopeba on the Rio das Velhas valley. In the Itabira district Caue and Gongo Socco are the only deposits now mined. Caue is the famous iron peak from which will be mined the rich iron ore to be exported through the Rio Doce Valley and the harbor of Victoria. In the Itabirito district we find the Itabirito Peak deposit, which lies to the west of the narrow-gage railroad from Bello Horizonte to Lafayette. The Paraopeba district comprises many mines along the broad-gage railroad from Bello Horizonte to Lafayette. Those active at present are Casa de Pedra, Pires, Tres Irmaos, Saraiva (Feicho Funil), and Jangada. All of them are in the valley of the Paraopeba River. Casa de Pedra is operated by A. Thun & Co. and is in a position to ship about 600,000 tons of hard ore a year. Saraiva is owned by Minas de Ferro and has been active for the past three years.

[1] Authorized by the Departamento Nacional da Producao Mineral, Rio de Janeiro, Brazil.

Aside from the large iron deposits of Minas Geraes we find: Jequie, Santa Fe, and Jacobina range, in Bahia; Ipanema, in S. Paulo; Antonina, Morretes, and Pinhaes, in Parana; and Itajahy and Annitapolis, in Santa Catharina. In Matto Grosso the principal iron region is that near Corumba, at Urucum, where rich and abundant hematite is found.

Hematite is the main mineral and predominates in the deposits of Minas Geraes. Magnetite occurs and is predominant in the deposits at Bagia, S. Paulo, Parana, and Santa Catharina. Limonite is found cementing hematite in the canga ore. Itabirite is a quartzitic rock carrying in certain cases enough iron to constitute an ore.

Fourteen iron smelting plants are in operation, at present distributed as follows: 11 in Minas Geraes, 2 in the State of Rio de Janeiro, and one each at Sao Paulo and Rio de Janeiro. Their total production in 1939 reached 160,000 tons of pig iron and over 100,000 of steel. Most important of these is the Companhia Siderurgica Belgo-Mineira, which has its mills at Sabara and Monlevade. The plant at Monlevade is completely modern and three 80-ton iron smelting furnaces are operating. Charcoal is used as fuel, not only by the Companhia Belgo-Mineira, but also by all the others, and it is becoming scarcer and more expensive every day.

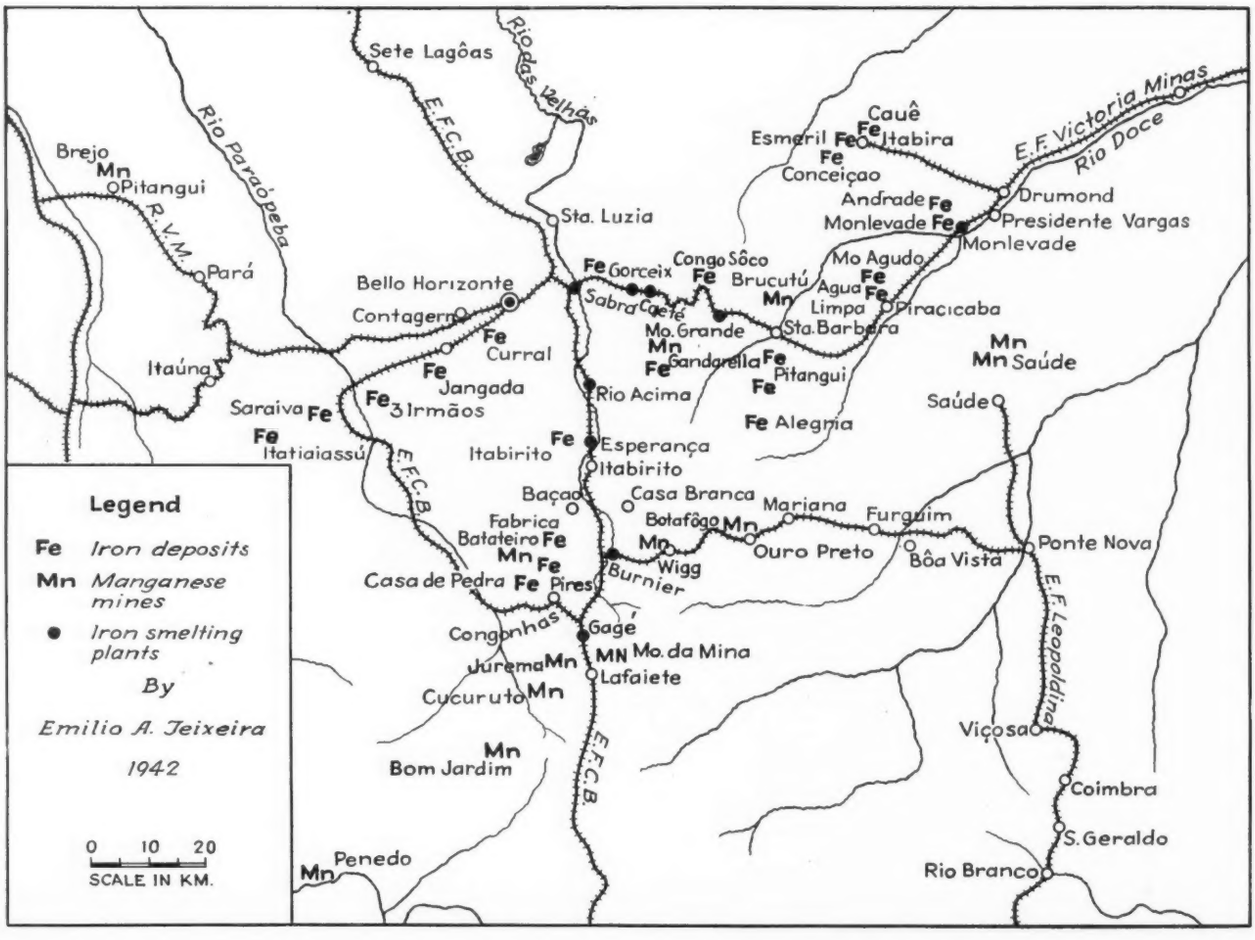
Now in construction at Volta Redonda, a new iron and steel mill will be the largest in South America with a capacity of 300,000 tons of steel products. Volta Redonda is a station on the main broad-gage Central do Brazil R. R. from Rio de Janeiro to S. Paulo. It was selected as the site of the new mill because it is the logical meeting place of the ore from central Minas Geraes and the coal from Santa Catharina. The total expenditure will be about $45,000,000, of which $20,000,000 will be a loan from Import and Export Bank. It is expected that the mill will be running early in 1944 under the direction of Companhia Siderurgica Nacional.

Manganese—Manganese deposits of commercial size are found in only three states in Brazil—namely Minas Geraes, Bahia, and Matto Grosso, all of them far from the coast line. The mines in Minas Geraes, in the central part of the State, have been worked for a number of years, but those in Bahia are of only minor importance as to reserves and quality.

In Matto Grosso, at Corumba, is found perhaps the biggest manganese deposit in the world, the Urucum property. Estimates of reserves vary, but latest reports mention between 20,000,000 and 30,000,000 tons of ore at this mine. Unfortunately it is on the boundary with Bolivia, 2,000 km. from the nearest Brazilian harbor at Santos. At present the Sociedade Brasileira de Mineracao is working the mine, and many shipments have been sent down the Paraguay River to Rosario. The entire deposit belongs to the federal government, but a concession has been given to the State of Matto Grosso.

Minas Geraes is the center of manganese mining in the country, and Lafayette is by far the most important district. There we find the famous Morro da Mina mine, which is operated by the Companhia Meridional de Mineracao, a subsidiary of the U. S. Steel Corporation. This mine continues to be the best producer in the country and has the second largest known reserve. It has an ideal situation as to transportation and mining, being served by a broad-gage branch of the Central do Brazil. Open-cut mining is used and the present output is about 20,000 tons of ore a month. Production is limited by transport difficulties at present and could be increased two or three times if additional facilities were available. About

Principal deposits, mines, and iron-smelting plants in Minas Geraes



5,000,000 tons of ore has been mined, leaving a reserve estimated at 4,000,000 tons. The ore as shipped now runs about 46 percent Mn and 7 percent Fe.

The A. Thun & Co.'s group of mines is situated to the west of the railroad. This group is formed by Sao Goncalo, Paiva, Jurema, Cocuruto, Pequiry, and Bom Jardim mines. All the work is done underground, and production is smaller and at a much higher cost per ton than at Morro da Mina mine. Their total output ranges from 6,000 to 8,000 tons a month. Aside from these two larger companies, manganese is mined by Sociedade Brasileira de Mineracao, Companhia Mineracao de Penedo, and Empresa Continental de Minerios.

Manganese ore mined in Brazil consists of the ordinary oxides, but as a general rule the ore may not be considered as high grade. A general average for exported ore may range from 44 to 48 percent. Some form of concentration will be required for utilization of Brazil's many low-grade properties and many of the large mines are losing large quantities of fine ore which could be saved by improved metallurgy. In any event, it may be estimated that Brazilian reserves of ore containing between 40 and 50 percent Mn amount to about 25,000,000 or 30,000,000 tons.

Coal—Brazil's coal basins are in the southern part of the country, in the states of Sao Paulo, Parana, Santa Catharina, and Rio Grande do Sul. They have been mined for many years, but only in the last decade has coal mining become progressive. Assistance is given by the government ruling which requires the use of a certain ratio of Brazilian to imported coal. The heating quality of coal varies with the basins between limits of about 4,000 to 7,000 calories. In Rio Grande do Sul the coal seams are thick, but caloric content is low. In Santa Catharina the opposite is true. Farther north, in Parana, the coal is probably the best in Brazil, but the beds are still thinner. Ash is the main problem, but it can be partly eliminated by processing. The S. Jeronimo coal mine, in Rio Grande do Sul, has now a modern McNally installation, which lowers ash content to about 12 percent. Its capacity is 2,400 tons per 24 hours. Small plants are operated at Rio Deserto in Santa Catharina and at Barro Branco mine.

Situated in Rio Grande do Sul, the two most important mines are those of Companhia Estrada de Ferro e Minas de S. Jeronimo, at Arroio dos Ratos, and Companhia Carbonifera Riograndense, at Butia. The State government is operating the Rio Negro mine on the main railroad from Bage to the harbor of Rio Grande, and interest has been shown in the coal basins at Herval and Candiota on the same railroad.

The coal fields of Santa Catharina lie in the southern part of the State near the sea coast in a belt about 50 km. long and 20 wide. Seven companies operate in this area with a combined output of nearly 200,000 tons per year. Most important among them are the following: Companhia Nacional de Mineracao Barro Branco, Sociedade Carbonifera Cresciuma, Sociedade Carbonifera Prospera, and Companhia Carbonifera Urussanga e Minas do Rio Carvao. All the mines in this coal area depend on the Thereza Christina railroad for transportation to the harbor of Laguna, and the government has begun work to increase both rail and harbor facilities.

In Parana the coal fields are situated in the Rio do Peixe, Rio das Cinzas, Thomazina, and Barra Bonita districts. Marked interest exists in these new areas, and latest reports indicate large basins of good-grade coal. Production is still small, and transportation to the sea at Paranagua harbor is poor.

American specialists in preparation of coal and on mining methods are already working in cooperation with the Department of Mineral Production in efforts to make Brazilian coal suitable for use in the Volta Redonda steel plant. Reserves of coal in the country, taking into consideration all available information, may reasonably be estimated at several hundred million tons.

Zirconium—Zirconium is found in the Pocos de Caldas plateau at the boundary of Minas Geraes and S. Paulo. The region is served by the Mogyana railroad which joins the Paulista R. R. at Campinas. Nearest seaport is Santos, a distance of over 400 km. from Pocos de Caldas. The minerals are baddeleyite and zirconite, found both in veins and in alluvial deposits. Serrote is the most important mine, due to its location and quality of ore. It lies only 2 km. from the railroad station at Caseata. Open-cut mining is used, and the ore is washed, hand jigged, and sorted at the mine. Crùzeiro do Sul (Southern Cross) type is a standard ore running 85 percent ZrO_2. The commercial type is used as refractory and runs from 65 to 75 per cent ZrO_2. The richest ore contains from 90 to 95 percent.

The Companhia Geral de Minas controls the best properties in the plateau and could increase its output considerably. Between 1934 and 1940 8,500 tons were exported, of which 2,300 tons was high-grade ore. Reserves are large. In an estimate made by myself and Paiva Oliveira in 1936, a total of 2,500,000 tons was given for all the deposits in the plateau.

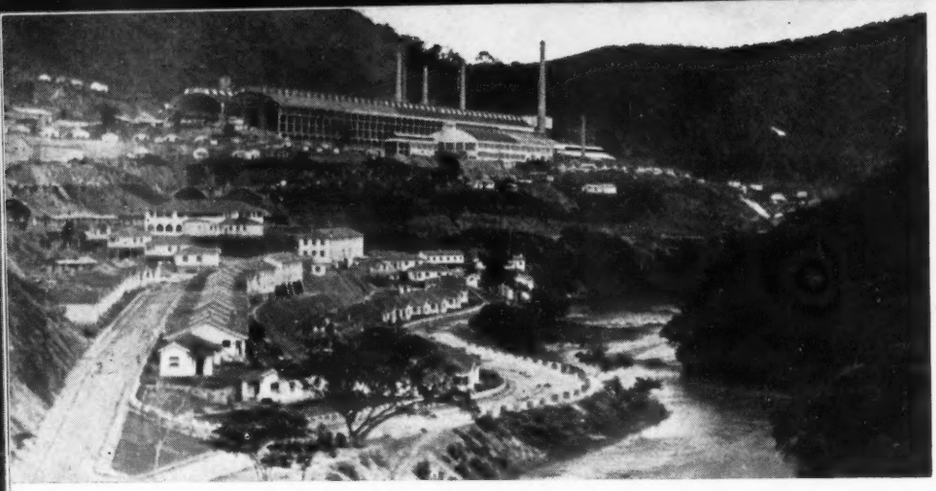
Quartz Crystal—Brazil enjoys almost a monopoly in quartz crystal production, and present demand has exceeded all expectations. Minas Geraes, Bahia, and Goyaz are the large producers, with Bahia leading in quantity

Moro de Mina manganese mine, a subsidiary of U. S. Steel Corp. in Minas Geraes

Juca Vieira 250-ton mill and mine, a gold property near Caete in Minas Geraes

Mill of Sao Bento gold mine near Santa Barbara expected to treat 300 tons daily

Plant for treating bauxite near Pocos de Caldas in Minas Geraes. Output goes to United States



Monlevade iron and steel works in Central Minas Geraes, property of Cia. Siderurgica Belgo-Mineira

of production but with Minas Geraes producing the better crystals.

The Paeu mine of Minas Geraes lies in slates of the Bambuhy Series, of Silurian age. Mining consists in following a pegmatite vein and an alluvial deposit in a basin. A preliminary selection is made at the mine, and the quartz crystals are then trucked to Bello Horizonte, where they are sorted, classified, and boxed for export.

Thousands of prospectors are now working these various deposits and many small fortunes have been quickly made. Weight of crystals exported in 1941 was 1,980,000 kilos valued at $4,450,000.

Mica—Mica is found almost exclusively in the eastern part of Minas Geraes, in an area roughly 300 km. in length and 200 in width, running from Theophilo Ottono to Carangolo. The mica, largely ruby muscovite, is found in pegmatite dikes in an old gneiss formation. Mining methods used are still very primitive.

Espera Feliz, Caparao, Figueira, Conselheiro Pena, Suassuhy, and Ramalhete are the principal producing centers, but mica reserves are enormous. There are 30 trimming plants in the mining districts, of which 20 are for preliminary and 10 for final trimming. Brazilian labor is used and both production and efficiency are increasing every day. Mica is sold locally to buyers from Rio de Janeiro or from the trimming plants. In 1940 624,000 kilos were exported to the United States, Germany, Great Britain, Japan, India, France, and Italy. According to a government decree, the Axis nations are no longer permitted to buy, so that the U.S.A. is practically the only purchaser of Brazilian mica at present. The total value of mica exported in 1941 reached three times that of 1939.

Bauxite—In 1935 deposits of bauxite were discovered at Pocos de Caldas, in the State of Minas Geraes, by the Companhia Geral de Minas, which has pioneered in this work. The main deposits in the Pocos de Caldas plateau are cut by the Mogyana railroad between the station of Cascata and Pocos de Caldas. The haul to S. Paulo is 310 km. and to the harbor of Santos is 390. The most important deposits belong to Companhia Geral de Minas and Lindolpho Dias. Campo do Saeco is the best bauxite mine in the plateau and has an estimated reserve of over a million tons.

The company has a dressing plant in the outskirts of Pocos de Caldas, where pulverized bauxite is prepared for the Argentine market. A contract of 100,000 tons of bauxite for Reynold Metals Co., in the United States, was made early in 1941, and ore running 59 percent Al_2O_3, 7 percent Fe_2O_3 and 2 percent SiO_2 was shipped to Santos for the company mentioned.

Lindolpho Dias' mines were recently transferred to the newly organized Companhia Brasileira de Aluminio, which plans to make aluminum metal. The plant will be built near Sorocaba, State of S. Paulo, where cheap electric power is available. Total reserves at the Pocos de Caldas plateau may be put at 7,500,000 tons, including lower-grade bauxite. According to latest figures the amount of ore running above 58 percent will reach 2,000,000 tons. Other deposits in Brazil are: Muquy, situated in the State of Espirito Santo on the Leopoldina railroad 400 kilometers from the Rio de Janeiro. It has an estimated reserve of 1,000,000 tons and has been operated on a small scale. Mutuca is a bauxite deposit owned by the St. John d'El Rey Mining Co. (Morro Velho), and has about 2,000,000 tons reserves. The Companhia Electro-Chemica Brasileira controls the Gamba deposits, near Ouro Preto, and The Aluminum Company of America owns the Chapasao do Canga, near Santa Rita Durao. These lie in Minas Geraes. In the State of Maranhao there is a huge deposit of a phosphorus bauxite at the Trauhyra Island. Total reserves for Brazil are estimated as about 20,000,000 tons.

Chromite—Bahia is the only area where chrome deposits are of workable size. The two main areas are at Campo Formoso and at Santa Luzia. Both are served by the Estrada de Ferro Leste Brasileiro, and are situated 430 and 300 km. respectively from the harbor of Sao Salvador.

At the Cascabulho mine of Campo-Formoso, the ore runs between 45 and 50 percent Cr_2O_3. Reserves in sight amount to 150,000 tons. Controlled by Dr. Macambyra Monte Flores, these deposits are now being studied by government engineers in cooperation with a geologist from the United States.

Pedras Pretas is the oldest mine in Bahia and lies about 2 km. east of the station at Santa Luzia. It was worked during the last war by E. J. Lavim & Co. under my management, and about 40,000 tons of low-grade ore remain at the mine.

About 3,000 tons of chrome ore were exported in 1940, all from Cascabulhos. Transportation and ore concentration are the main problems to be considered in obtaining an increase of chromite production.

Diamonds—These precious stones, industrial and of the gem variety, are found in the States of Minas Geraes, the main producer; Bahia, Matto Grosso, and Parana. Except for two plants at Diamantina and one plant at Agua Suja, near Estrella do Sul, no modern equipment is used in mining the deposits. More than 210,000 carats were exported in 1940.

The discovery in 1939 of the Presidente Vargas diamond, of 724 carats, was the sensation of the diamond mining world. It was found by three very humble *garimpeiros* in the Santo Antonio River in Coromandel, Minas Geraes.

Gold—Gold is found in all states of Brazil except nine, but Minas Geraes is the largest producer. In the central part of the State we find the famous Morro Velho mine of the St. John d'El Rey Mining Co., the deepest mine in the world. It has a milling capacity of 1,000 tons daily of ore containing about 11 grams per ton. Reserves at Morro Velho mine have been increased considerably by underground drilling and now amount to over 8,000,000 tons.

Smaller deposits of low-grade ore are being worked near Ouro Preto, Caete, and Santa Barbara. Small deposits are also worked in Parana and Rio Grande do Sul. Prospects for new developments are encouraging wherever the Minas Series schists are found. In Minas Geraes, Goyaz, Matto Grosso, and Maranhao conditions are favorable and many good prospects are already being studied.

Nickel—Garnierite is found in minable quantities in the states of Goyaz and Minas Geraes. The Goyaz deposits, with an estimated reserve of 15,000,000 tons, are situated at S. Jose Tocantins, which lies about 1,500 km. from the sea at Santos and 300 from the railroad at Annapolis. Several unsuccessful attempts have been made to exploit this deposit, but very keen interest is

now shown in its development. Rich cobalt ore is found in the upper part of the ore formation.

At Livramento, in Minas Geraes, the Companhia Brasileira de Nickel is working a garnierite property using a 20-ton electric furnace to produce 20 percent ferronickel. Other properties in the same State near the Espirito Santo line at Ipanema are said to contain about 1,600,000 tons of garnierite ore.

Lead—The principal lead deposits are found in the State of S. Paulo at Apiahy and Iporonga. At the Furnas mine, the ore is a high-grade galena carrying silver and some zinc. To encourage development and production the State government has built a small 35-ton smelting plant in the district at Palmital. The region has very poor transportation and has not been thoroughly prospected. There are occurrences of lead in other states, but they are undeveloped and production is small.

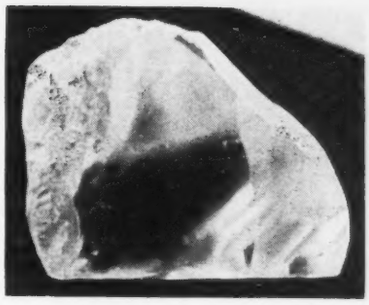
Copper—Large copper deposits are lacking in Brazil, and the government is attempting to locate mines of some economic importance. I made a preliminary study in Rio Grande do Sul, and a drilling campaign is now being pursued by the federal and State governments in an effort to develop a large deposit. Deposits in Bahia and Parahyba are also being prospected.

Other Minerals—Tungsten, in the form of wolframite and scheelite, is found in Minas Geraes and Rio Grande do Sul, but the deposits are still in the development stage. At Ouro Preto pyrite is mined for use in sulphuric acid plants, and reserves are given as 13,000,000 tons. Eight cement plants are in operation in Brazil, and a phosphate plant in Sao Paulo treats 250 tons daily of an apatite ore to produce a concentrate containing 60 percent P_2O_5. Alluvial deposits of rutile are being worked in Goyaz and Minas Geraes.

Prospecting has disclosed the presence, in various states, of zinc, fluorite, magnesite, asbestos, oil, molybdenite, graphite, and rock salt, and exploration or development is proceeding on all these deposits. Mention of this fact serves to illustrate the vast possibilities of Brazil as a source of mineral wealth.

Considerations

Transportation and loading facilities are a serious problem in developing the iron and manganese mines. The nearest harbors south and east are Rio de Janeiro and Victoria, where loading



President Vargas diamond of 724 carats found at Coromandel, Minas Geraes, 1939

is inefficient, slow, and very expensive, and a quick and cheap transfer of ore into ships must be provided at both Rio de Janeiro and at Victoria.

Railroad transportation is today a serious difficulty. Shipments of ore from the mines to the sea are delayed by lack of sufficient rolling stock as well as by deficiencies in the roadbed itself. The Victoria e Minas railroad to Victoria harbor will be improved to carry high-grade iron ore from the Itabira district, and the same must be done to the Central of Brazil railroad to handle the manganese and iron output of Central Minas Geraes.

Technical help to mining is lacking in the country. The school of mines at Ouro Preto is the one institution where mining is taught, but only a few graduates are turned out every year. The result is that the increase in mining activities of the last years has found the country without sufficient capable mining men. Outside help is to be had, but foreign engineers usually demand high salaries and many new companies or individuals cannot afford to pay them. The idea of organizing new schools is growing, and a plan for a mining school in Minas Geraes, founded by the mining companies operating in Brazil, is being developed.

Modern mining and milling methods must be introduced in the industry. I think this will eventually come in the opening of the new mines, because the large companies operating iron, gold, and manganese mines are still using old methods and as little machinery as possible.

Brazil's mining code came into use in 1934. The biggest and most radical change from the old laws is that underground wealth, not manifested in the specified time, passed into government ownership. Since then a few changes have been introduced. The restriction made as to participation of foreign capital still continues, but the formation of Brazilian companies in connection with outside investment is possible in individual cases covered by special decrees. The government is interested in the development of its underground wealth because it is so greatly needed, not only by Brazil but also by all the Americas, and government assistance may therefore be expected for new mining enterprises.

Near Jurema mine, in Minas Geraes. Washed and screened manganese ore ready for shipment

Working face in open pit of Morro da Mina manganese mine, Minas Geraes

BOLIVIA

The nation's economy rests upon the export of tin, antimony, lead, tungsten, and other metals

G. V. Bilbao la Vieja
Engineer, Banco Minero de Bolivia, La Paz

PRACTICALLY the entire economy of Bolivia rests on its mining industry, for nearly 90 percent of the value of its exports derives from mineral products. This has been true even from pre-Colonial times, when small quantities of gold and silver were mined; but under the Spaniards, those industries thrived. With amazing energy in opening and developing unexplored territory, and with abundant labor at their disposal, the *conquistadores* were able to put the Andes Mountains in the world map for reasons other than geographic accident. The richness of Potosi mountain became legendary.

With the foundation of the republic, Bolivian economy set out to follow the way marked by tradition, but labor costs increased, other adverse factors developed, and production of gold and silver languished. Before 1900, Bolivia had turned to copper, bismuth, and, above all, tin, which had been found in the old Spanish silver mines. The copper industry remained small, mainly due to the great distances between mines and consumers. Bolivia was the largest producer of bismuth until prices dropped, but thereafter bismuth was recovered only as a byproduct in the production of other metals.

After 1900, commercial quantities of antimony, tungsten, zinc, lead, and mercury were mined, and the first two industries have prospered until they are now among the world's largest producers. Tin, however, covers nearly 80 percent of the total value of mineral exports, which reached Bs. 2,830,214,000 in 1941, of which tin accounted for Bs. 2,218,602,000.

The more important mineral deposits are in the region formed by two branches of the Andes and the *altiplano* (high plateau) between them. This area comprises the departments of La Paz, Oruro, Potosi, and part of Cochabamba and is the most populated region of the country. The cities of Oruro and Potosi were built near important mines, and even today are almost entirely dependent on the mining industry. In the eastern region, characterized by agriculture and cattle raising, the oil fields of the Bolivian Chaco and deposits of asbestos and mica are the only minerals found to be worth exploiting. Complete statistics are not available, but of the total population of Bolivia, roughly 3,500,000, it has been estimated that 70,000 are employed in the mining industry.

Tin

At present, the Allied front retains among the main producers of tin, only those of Bolivia, Belgian Congo, and Nigeria. With stocks on hand of about 170,000 tons, it is expected that the democratic countries will be able to satisfy their more urgent needs. Tin exports of Bolivia in 1941 reached 42,877 metric tons, an increase of 4,346 tons over the figures for 1940. Further increase is predicted for 1942 if tin prices are readjusted favorably and machinery and materials are supplied regularly.

By the contract signed with the Metals Reserve Co. on Nov. 7, 1940, and in force until July 1, 1945, all Bolivian tin goes to the United States, with the exception of that of the Patiño Company, which in 1941 was 20,964 long tons and goes by former agreement to England. In a contract recently negotiated with the Metals Reserve Co., the price of Bolivian tin was increased from 48½c. U.S. per pound of fine tin at United States ports to 60c. f.o.b. South American ports. From Dec. 1, 1941, by agreement between the British Government and Pa-

Bolivian Mineral Exports

(In Metric Tons) 1932—1941

Year	Tin	Tungsten	Antimony	Copper	Lead
1932	20,918	411	1,469	2,017	5,488
1933	14,957	142	1,896	1,448	7,845
1934	23,224	530	2,055	1,635	11,361
1935	25,408	817	3,670	1,904	10,223
1936	24,438	1,044	6,565	3,215	13,532
1937	25,531	1,081	7,127	3,693	18,288
1938	25,893	1,517	9,437	2,885	13,168
1939	27,648	2,002	10,060	4,056	14,110
1940	38,531	2,510	11,753	6,660	11,663
1941	42,877	2,613	14,870	7,274	15,653

Year	Zinc	Silver	Bismuth	Sulphur	Asbestos
1932	12,968	128	2	300	.....
1933	13,412	170	2	2,500	.....
1934	9,605	169	68	5,710	.....
1935	8,271	193	21	4,250	.....
1936	13,635	318	63	950	.....
1937	11,529	294	31	1,739	21
1938	10,706	198	17	1,658	21
1939	7,769	225	13	2,160	2
1940	12,197	175	19	4,130	70
1941	6,065	229	11	2,486	210

tiño Mines & Enterprises Consolidated Inc., the price of tin sold by the latter to Great Britain has been set at a minimum of £227 18s. 4d. per ton. This price will be increased whenever standard tin quotations rise above the set minimum.

The three big tin-producing companies are Patiño, Hochschild, and Aramayo. Together they made up 81 percent of the total production in 1941 with 49, 26, and 6 percent, respectively.

Llallagua is the most important property of Patiño's group and also the largest known tin lode deposit of the world. At present, a sink-and-float plant is being planned for its Catavi concentrator. By all indications, this group will be able at least to maintain its present output for the next several years. Colavi, recently purchased by Patiño and located 60 km. from Potosi, contains a sandstone bed 1.25 meters thick with 2 percent tin content. The exploration work indicates that it may become an important producer.

Hochschild is perhaps the leader in experimentation and introduction of new methods for the beneficiation of tin ores. A few months ago a sink-and-float plant was installed in Colquiri, but last reports say that this plant is being torn down for re-installation in Unificada. On this property, also, a pilot plant will be erected for the treatment of sulphide, complex, and low-grade ores, by the Tainton process. The plant, treating 200 tons a day, will probably be ready within a year. Production of the Hochschild mines is expected to increase.

The Aramayo group has purchased the San Juan mine, near Animas, in the Chocaya district, a new shaft has been sunk in Animas, and a new sorting plant has been installed to increase the capacity of Telamayu mill. From these changes, it is logical to expect a larger output from the Aramayo mines.

Recently, the mine showing the greatest increase in production was Santa Fe, which, from a monthly average of 47 fine tons in 1940, has increased in 1941 to 89 fine tons per month. This property, with more mechanization of its plant, promises to continue increasing its output.

Racachas, so far a small producer, has discovered recently an orebody assaying about 6 percent tin, in which the owners claim to have developed more than 60,000 tons of ore.

Among the relatively new deposits, Urania stands out as a large reserve of tin and tungsten. The main vein, it is reported, is 4 meters wide and runs 1.15 percent WO_3 and 1.40 percent Sn. At present a high-grade complex concentrate is sent to the United States for refinement. Probably one of the most extensive fields for expansion of the Bolivian tin industry is in the placer deposits, hitherto not developed for lack of exploration and of adequate machinery.

The latest attempt to smelt tin in Bolivia, a plant to use the Lamy process, was made by Mauricio Bony in Oruro. It is reported, however, that all idea of completing this plant has been definitely abandoned by those interested in the venture.

Tungsten—The Bolivian production of tungsten since 1938 has been steadily increasing, but at a lesser rate than might be expected from the richness of the ore deposits and the favorable market. The principal producer is Compagnie Aramayo de Mines en Bolivia, the operators of which hope to increase the output of Tasna and Pacuni mines, which have been extensively developed. The aggregate yield of the other producers will be increased through several projects that have been financed and are already being carried out. Of these, the following are worth mentioning:

Urania, to which reference has been made in discussing tin. This mine, producing both tin and tungsten, has been worked on a small scale, obtaining a recovery of about 15 percent using a combination of gravity, flotation, and magnetic-separation methods. Three months ago, with a section of new tables installed, the recovery was raised to 40 percent of the tungsten and 30 percent of the tin, in 60

Catavi tin concentrator of Patino Mines & Enterprises, Bolivia

percent concentrates of composite tin and wolfram. A new 500-ton plant is being designed, with which it is expected to obtain recoveries of 65 per cent and 50 percent, respectively.

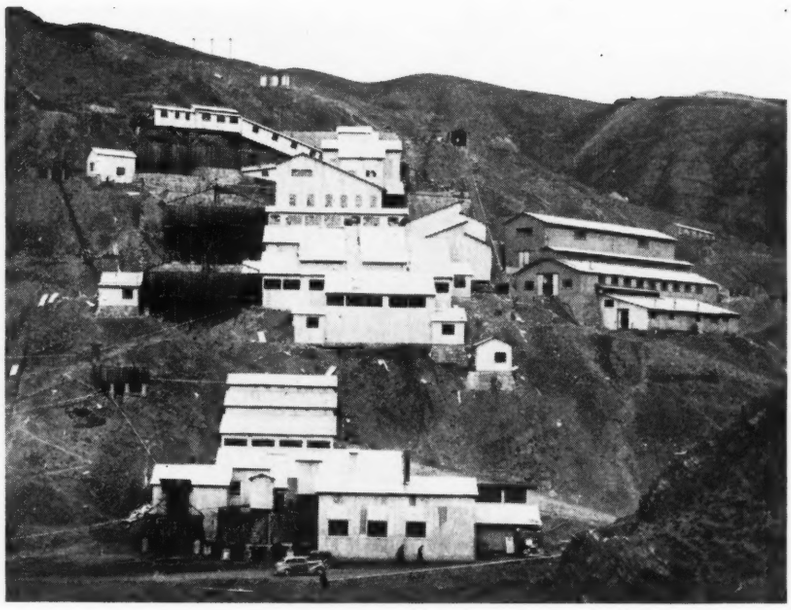
In Bolsa Negra, the capacity of the plant will be increased within six months to an annual production of 350 tons. The deposit of Perfeccionada, operated by J. A. Inslee, is expected to maintain this year a producing capacity of 500 tons. Perfeccionada and Taminani, in the same region, with ore estimated at a million and a half tons containing 0.20 percent WO_3, are among the most important known reserves.

Sociedad Empresa Juliana works a scheelite vein about 3 meters wide containing 2.5 percent WO_3. The orebody has been developed to assure a large production once a new concentrator is installed. Patiño Mines in its Cami property is increasing its output, which, it is hoped, will reach 500 fine tons per year, working the Chicote River by draglines. Banco Minero de Bolivia, which buys the production of the small miners, has been exporting an average of more than 600 fine tons yearly.

Uncertainty regarding the post-war market of tungsten, a commodity very little in demand in times of peace, makes it difficult to interest private capital in large investments in tungsten mining. It is only logical that an increase in prices would furnish greater incentive to capital and would intensify production. A recent agreement between Bolivia and the United States has been announced by which Bolivian tungsten sold at $21 U.S. the short unit to the Metals Reserve Co. will, in effect, be released from about 50 percent of the duty now paid. This will amount to an increase of $4 per unit.

Antimony—The stibnite orebodies are, as a general rule, of spotty character and the ore is mined and concentrated by rudimentary hand methods, losing in the process tailings carrying between 5 and 10 percent antimony. Banco Minero de Bolivia, buying the production of the small miners, accounts for more than 80 percent of the total exports of antimony. Seventeen other mine operators, including Bernal Hnos., Cruz, Eterovic, and Prisk & Wright, provide the remainder. The main producing regions are those near Tupiza, Llallagua, and Oururo.

Recent demand for antimony has caused a steady increase in production, from 7,127 metric tons in 1937 to 14,870 tons in 1941. The future of this industry rests entirely on prices paid. However, re-treatment of tailings and local smelting of concentrates would probably reduce the cost of production of Bolivian antimony and give it a stronger position in the post war market.



Tin concentrator of Cia. de Minas de Colquiri, a Hochschild property

Lead, Silver, and Zinc—Bolivia has been one of the richest sources of silver, and is now potentially an important one of zinc. So far, the deposits of lead discovered have proved to be of little industrial value, except where accompanied by other valuable metals.

Complex ores of silver, lead, and zinc are mined mainly in the southern region of the country. Compania Huanchaca is the most important producer of concentrates of these metals and practically the only producer of zinc in Bolivia. The Hochschild company, which operates Huanchaca, is also owner of Matilde mine, near Titicaca Lake, which has been explored and developed recently. According to reports, there are 2,000,000 tons of ore developed containing 20 percent zinc, 24 percent lead, 1.60 oz. of silver per ton, and traces of copper.

On Oct. 2, 1941, a contract was signed between the Metals Reserve Co. and Banco Minero de Bolivia and Mauricio Hochschild, for 300 short tons of lead concentrates monthly at $32.12 U.S. per ton, taking as a basis concentrates of 65 percent lead. The production ordinarily sent to Argentina is excluded from this contract.

Gold—Many deposits of gold are known both in veins and in placers, the latter being of more importance as determined by several studies of the region north of La Paz. Aramayo company, in its exploration of the gold placers of Tipuani, has spent in the last few years about $2,000,000, but operations are today at a standstill because of difficulty in obtaining machinery and material.

Copper—Although Bolivia has been mining copper for many years and has some rich deposits, particularly those of Corocoro, Turco, and Chacarillas, because of the cost of shipping concentrates to the smelters outside of the country the mining of this low priced commodity has not prospered. Corocoro mines of American Smelting & Refining Co. account for about 70 percent of the Bolivian production. Apparently the plans made to double the capacity of the company's mill have been abandoned temporarily. By a contract made with the United States in April, 1942, Bolivian copper will be sold on the same terms as those for Chilean copper. It is not believed, however, that this arrangement alone will result in increased production.

Sulphur—The sulphur deposits are similar to those of Chile and are near the Chilean border. They are being mined on a small scale. Banco Minero de Bolivia started in April, 1942, a survey and examination of the sulphur deposits. From the results of this survey, expected to occupy six months, production will be intensified on the basis of a modern sulphur treating plant.

Bismuth, Asbestos, Mica, and Others—The production of bismuth, which once held first place in the world, has fallen considerably. Aramayo company continues to be the principal producer, but recently it has exported only small amounts of oxide and sulphide concentrates assaying about 30 percent bismuth. The metal is also found in some tin ores, from which it could be obtained economically by modern methods.

Existence of asbestos and mica in the regions of Cochabamba and Santa Cruz has been known for a long time, but only of late has interest in these deposits been aroused. They are of good quality, but transport difficulties are great. There have also been recorded small exports of cobalt, selenium, and mercury; and an ample field, little explored and worked only on a very small scale, is that of the deposits

of non-metallic minerals in Potosi.

Bolivia contributes to the war effort of the democracies with its mining industry working at full capacity. Malayan sources of tin having been cut off by the Japanese, Bolivia and, on a lesser scale, Nigeria and the Belgian Congo, are the only important sources of tin to supply the Allied front. In the provision of other minerals vital for war, such as tungsten and antimony, Bolivia's part is also of importance. This situation marks for the mining industry of the country a period of activity comparable only to that of the first World War.

As we have seen, Bolivia's economic life rests more heavily on the mining industry than is true of any other country. Moreover, its economy is based on a single product, as tin by far is its most important item. Mining of tungsten and antimony is subject to transitory demand, and they cannot be considered basic products.

Bolivia has followed the mining tradition left by the Spaniards, and because so many were attracted by the fascinating returns that mining sometimes offers, a disproportionate attention was devoted to this activity. Other sources of income such as agriculture and cattle raising were neglected, with the result that today they are not able to supply even the most elementary local needs. Articles of prime necessity, such as flour, sugar, rice, and potatoes, have to be imported and paid for in gold, thus depleting Bolivian gold reserves and rendering currency stabilization more difficult. As an aftermath of the Chaco war, Bolivian currency depreciated from Bs. 3.07 per U. S. dollar in 1931 to Bs. 46.00 in 1942.

In analyzing the industrial and economic situation of the country, not much effort is required to see that the logical thing in this present favorable hour is to strengthen the mineral industry, and, with its returns, help agriculture, cattle raising, and other secondary industries in an effort to produce a varied economy, more independent of the unstable market of strategic minerals. In that way the country could be made more self-sufficient, new sources of income for the State would be created, and not so much dependence would be placed on the mining industry. Whatever conditions characterize the post-war period, it is only reasonable to fear an immediate drop in the price of metals, as occurred at the end of the first World War, and unless other provision is made, Bolivia may suffer accordingly.

In the economic development of Bolivia, several factors should be taken into consideration. The most important are government, prices and markets, capital, technical direction, and mechanization. On one hand, effective increase of capacity and reduced costs of production of the typical Bolivian minerals, tin, tungsten, and antimony, should be sought, so as to yield more profits in the present period, and to be better prepared to compete in the world market later. On the other hand, diversification of the mining industry should be undertaken, promoting the production of zinc, silver, lead, gold, copper, sulphur, nickel, asbestos, mica, non-metallic salts, and others in which the country is relatively rich, in order to take advantage of its varied mineral resources and defend the industry from the changing demands for raw materials.

Counteracting the effects of the government decree of June 7, 1939, the present constitutional government has done much to fill the needs of the mining industry. Taxes have been revised scientifically at a figure that would maintain the incentive of profits that are justly expected of mining investments.

A problem that needs very special attention, and the solution of which is required in every scheme for the development of the natural resources of the country, is communications. There are only 2,276.5 km. of railroad in Bolivia and automobile roads are few and of poor quality. In this situation, transportation is expensive. The agricultural and cattle-raising industries of Santa Cruz and Beni cannot bring their products to the markets of the *altiplano*. The Chaco oil flows more easily to Argentina than to the Bolivian industrial centers; and, in general, whole regions of the country, because of the lack of transportation facilities, remain unexplored or undeveloped.

The coming of capital to Bolivia, which today under a stable government offers all guarantees, is of the utmost necessity. Banco Minero de Bolivia, created to help small industries, has been doing it on a small scale, with a capital of about $1,250,000, distributed in the purchase of minerals and in small loans to several producers. A mine consulting department, with its corresponding laboratories, and a stock of materials for the exploitation of

Grinding copper ore with a primitive quimbalete at Chacarillas, Bolivia

Hand concentration of wolframite at Taminani, one of the largest of Bolivia's tungsten reserves

mines, has also been maintained. Now, with the creation of the Corporacion Boliviana de Fomento, this help, together with the promotion of the other industries, is to be given under better conditions and on a much larger scale. Corporacion Boliviana de Fomento will aid with a $25,000,000 capital, lent by the United States. With regard to the mining industry, it has been said that Bolivian and North American engineers will study and control the investment and an adequate supply of mining machinery and materials will be kept on hand.

Lately, in the supply of hardware, a business almost exclusively in the hands of German concerns, an acute shortage has been noticed. This affects seriously the small miners, as the big companies, with more vision and more capital, accumulated their own stocks of hardware. It is hoped that the solution of this problem as a part of the program of the Corporacion Boliviana de Fomento will soon be a reality.

The lack of technical advice in the work of the small producers is responsible for the inefficiency of the methods employed. Banco Minero de Bolivia operates an experimental ore-dressing laboratory, and its engineers in the field give miners technical advice on their operating problems. With the same purpose, the engineers of the United States Economic Mission to Bolivia, John Worcester and Ernest Oberbillig, have been working since their arrival a few months ago. Previously the United States Bureau of Mines sent William Vanderburg to report on the possibilities of the mining industry.

The big mining companies of Bolivia are operated by North American engineers, although in the past they were largely run by English and German. Since 1908 a school of mines has been maintained in Oruro, with but few teachers and poor equipment. Graduates from that school, among whom there are some good engineers, number about one hundred, but at present not more than thirty are practicing their profession. There are also six Bolivian mining engineers who have graduated from North American schools. These few properly trained Bolivian technical men cannot man the whole mining industry and the government mining bureaus as well; therefore, most small mines are run inefficiently and experience considerable losses, especially in the concentration of their ores. With only small expenditure for purchase and installation of machinery, and under proper guidance, recoveries could be easily increased on an average of 15 percent, saving at the same time much of the labor used today under the rudimentary methods employed in many small properties.

During recent years, mining labor has been scarce, and with the present intensification of production, labor shortage will limit the increase of mining unless the industry is more highly mechanized. This would have the added advantage of obtaining a bigger and better utilization of the ore reserves, and extended mechanization of the low-grade tin deposits would undoubtedly open a vast field for the future of the tin industry.

So far, no geologic survey of Bolivia has been made. Such a survey, besides helping the mining industry in the exploration and development of new orebodies, and outside of other military and civilian purposes, would give a more scientific basis in planning a more efficient utilization of the natural resources of the country. The Instituto Geografico Militar began a short time ago to make a geodetic and topographic survey of the country.

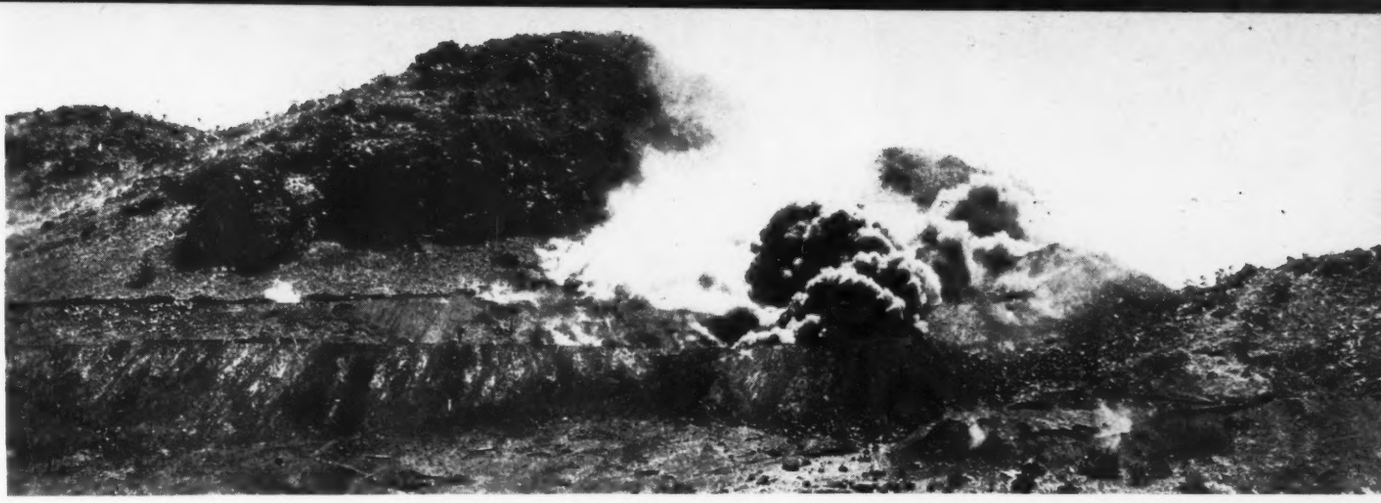
MEXICO

Government joins with large and small mine operators to speed production of vital minerals

Alberto Terrones Benitez
Mining Attorney, Mexico, D. F.

WITH the execution in 1521 of Cuauhtemoc, last of the Aztec emperors, the Spanish conquerors of Mexico were free to initiate a vast exploitation of the country's mineral wealth, which, pursuing its violent career through generation after generation, even to the present day has been unable to exhaust this huge storehouse of raw material. For example, silver, found and mined almost immediately by the Spaniards, has flowed from Mexico's mines in an uninterrupted stream which in 1929 reached a peak of about 3,300 metric tons a year. Total production of silver from 1521 to the present is in the neighborhood of 210,000 metric tons, yet apparently silver mining may continue indefinitely at its present rate.

Established immediately as the chief industry of the country, mining ac-



Mining iron ore in the Cerro de Mercado, huge iron deposit in Durango

tivity has ever since been inextricably bound with Mexico's economic and political growth. Wars have been fought and governments overthrown in struggles for possession of its unlimited natural resources, and few other countries can tell stories of the past as wild and colorful, so full of romantic incident, as the history of Mexican mining. Certainly mining has been developed in Mexico to a degree wider and more varied than that of any other of the Latin American states. For example, not only does Mexico have a leading place in the production of silver, petroleum, copper, lead, and zinc, but she produces significant quantities of iron and steel, coal, gold, mercury, antimony, manganese, tungsten, and even tin. No other one country of the Hemisphere, except the United States, can claim as much.

Naturally this abundance of raw material has been a lure for all varieties of exploiters, most of them hard, adventurous men who took what they wanted and paid little attention to laws or properties. However, as its political organization has become more settled, so too has its mining industry, and today one finds Government, managers, and workers gradually becoming united in the single-minded purpose of bringing to the service of the United Nations all that Mexico has of the most vital materials of war. These efforts are in most refreshing contrast to the attitude of suspicion, dislike, and defeat which has pervaded the mining industry for the past few years. Attributable in part to the world-wide depression, and in part to a long and exhausting series of labor-management disputes, mining underwent a serious slump in recent years, from which it is only beginning to emerge. For the present, at least, these labor disputes are being shelved and one may expect comparative peace on the Mexican mining front for the duration.

Silver production, languishing since 1929, has recently come to life under the stimulus of war demands, and so great is the demand for the metal that a flourishing local market has developed in Mexico City in which prices have steadily risen until, at latest report, 65c. an ounce was being paid for silver. This activity has, of course, produced some wild speculation, and mining districts long since abandoned are gradually filling with prospectors and miners spurred on by the hope of reviving the old days when the enormous *conductas* freighted the silver from the hills of Zacatecas and Guanajuato and silver pesos, enough for all, were coined freely at the nearest mint.

That these dreams are likely to remain just dreams is evident, but a rational scheme for silver development has now some hope of success, and negotiations are in progress in Washington by which members of the Mexican Embassy are seeking some adjustment of the price of silver in order to stabilize production. The chief producers of silver are, as they have been, the larger mines, such as Real del Monte, Pachuca, La Reforma, Fresnillo, and Santa Eulalia, but there is a growing interest in reopening some of the many mines abandoned long ago because of high mining costs and the low price of silver. Guanacevi, in Durango, a lead-zinc district, is the scene of activity which should yield much silver as well as base metal, and similar hopes are held for the Topia district and other regions in Chihuahua and Michoacan.

Modern Equipment Main Need

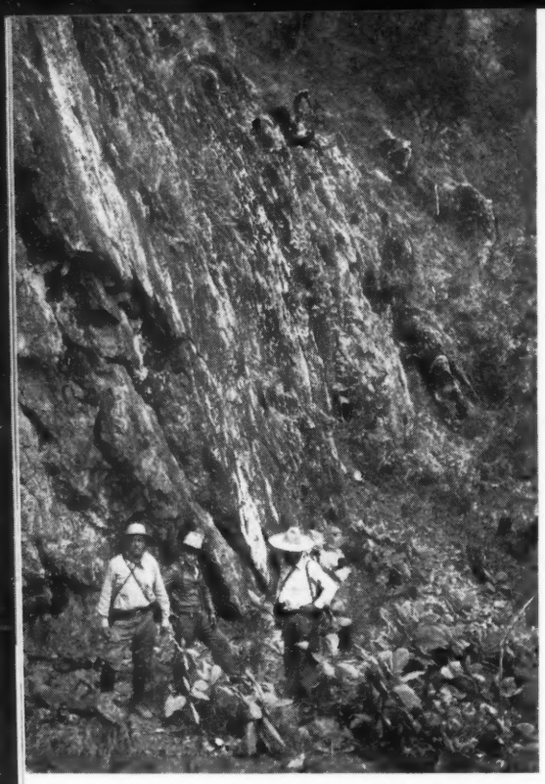
Lack of equipment is the chief obstacle facing most of these projects. For example, in the Orito district of Durango, gold miners for lack of anything better are using an old arrastra installation hewn from the granite rock hundreds of years ago by their Spanish forebears. That gold and silver mines may have to continue to use such makeshifts is, of course, likely in view of the need of machinery in producing the more strategic minerals, but the present activity is at least furnishing information which will be of value in post-war mineral production.

Such is the variety and all-embracing nature of modern war that practically any metal or mineral other than gold is now considered strategic. Mexico is particularly rich in most of these metals, but the deposits of many of them are in remote areas not well explored, and production may not be expected to increase until improved transportation facilities make it possible. Copper production, for example, is at about the capacity of present installations, and no new major producers have been located for immediate use. Greene-Cananea, in Sonora; Compagnie du Boleo, in Lower California; and Moctezuma Copper Co., in Sonora, are the chief sources of copper at present.

Mexico's iron and steel industry is receiving considerable attention, and production from the famous Iron Mountain, the Cerro de Mercado, in Durango, is being increased. The labor troubles which for so long have hindered the operation of the Monterrey blast furnaces and steel mills are being settled, and work proceeds smoothly. Steel and rolling mills are working at capacity because of the tremendous demand for steel, particularly at home, where the Government is planning much improvement of the railroads of Mexico.

Zinc and lead mining, which suffered considerably when the war cut off European markets, has been stimulated by contracts with the Metals Reserve Co. to purchase 250,000 tons of lead and 200,000 tons of zinc in Mexico. The larger companies, however, still regard the future with some uncertainty, for quite recently numbers of serious strikes have well-nigh prevented further operation of some of the larger mines. Prospectors are out seeking new deposits and some discoveries have been made—for example, an extremely promising outcrop of lead-zinc ore has been found in the Coicoyan Range in Oaxaca.

Antimony and mercury are being mined in ever-increasing quantities, and search for new deposits is being pushed. The Huitzuco mine, in Guerrero, remains the chief producer of concentrates of both these metals, but other mines are beginning to compete with it. Mesa del Toro, near Guana-



Outcrop of large lead-zinc prospect, Coicoyan Range, Oaxaca

juato; the Sahuaripa district, in Sonora; and the cinnabar deposits of northern Zacatecas show promise of important mercury production. With regard to antimony, machinery has been installed at mines in the Mixteca district of Oaxaca, and at several locations near San Luis Potosi, and shipment of concentrates to the United States is expected soon. The Commission for Stimulation of the Mining Industry also expects to develop large iron-ore deposits in the former area. Other promising antimony prospects have been found in the San Bartolo region, in Durango, and in various localities in Michoacan.

Tungsten veins are being worked in the Santo Domingo mine, near Nacozari, but few other producing areas are known. Numerous showings of tungsten have been reported, however, in the Archaeozoic metamorphic rocks of various areas in Oaxaca, Guerrero, Puebla, and Michoacan.

Stream tin has been found in central Durango in the gravels overlying the rhyolite tuffs of that region, and cassiterite veins have been located in the rhyolites of the adjoining Sierra Madre. Adding to the list of strategic minerals, a small but steady production of manganese ore comes from deposits near Mulege, in Lower California, and also from several mines in San Luis Potosi, Durango, and Michoacan. Cadmium, arsenic, and bismuth are also derived from Mexican ores, and prospectors have reported numerous showings of chromite, but no systematic exploitation has as yet been effected.

Available statistics show a peak of metal production in 1940 followed by a decline in 1941, probably caused by the blockade of European markets and the increase of labor difficulties. However, estimates for 1942, based on figures for the first quarter, indicate strong increases in all metals, and 1940's output may be surpassed. Production of the various metals in 1940 was as follows:

Mexican Metal Production—1940

Metal	Output, Metric Tons
Gold	27.5
Silver	2,570.4
Copper	37,602.5
Lead	196,253.4
Zinc	114,955.1
Antimony	12,267.5
Mercury	401.7
Tin	350.7
Iron	93,179.0
Manganese	1,696.4
Molybdenum	515.5
Tungsten	103.1
Arsenic	9,267.6
Bismuth	185.4
Cadmium	815.7
Graphite	12,327.1

Quite apparent to anyone interested in Mexican mining is the abundance of untapped resources awaiting development, but equally apparent are the difficulties facing such projects in the form of taxes and labor troubles. No company in Mexico has been free of them and many companies have in recent years succumbed entirely. A tabulation of mining enterprises in 1934 showed 879 mining companies operating in Mexico, of which 620 were owned by Mexicans, 207 by United States capital, and 52 by other nationalities. Between 1934 and 1940, 559 of these closed down, leaving only the hardiest organizations to carry on.

In 1941 the rollcall of Mexican mining showed the following:

No. of Mines	Monthly Output in Metric Tons
225	Less than 100
60	100 to 1,000
19	1,000 to 10,000
16	Above 10,000

Of these, nearly all the small and medium-sized mines were owned by Mexicans and the 16 largest were owned by American interests. These 320 mines, then, represented the fittest which survived the stormy period of socialization of industry and government reforms initiated by President Lazaro Cardenas.

Most notable in recent years has been the establishment of cooperative mining societies among the workers in various mining communities. The theory of these groups is that the miners themselves shall be owners, in part or in whole, of the mine and of its proceeds, and that all profits accruing from sale of minerals shall be divided among the members of the cooperative society in accordance with each man's efforts on behalf of the group. The humanitarian thought behind this movement has met, however, with but indifferent success. In a number of cases it appears that certain foreign operators, tired of endless wrangling with labor unions, and foreseeing the imminent exhaustion of their mine's reserves, have, with a grand gesture, turned these decaying properties over to the workers. Government subsidies have in a number of cases been required to keep these mines alive. Other groups have found it difficult or even impossible to work without a strong single authority respected alike by all employees. Government troops were recently called to prevent bloodshed between factions of a cooperative group in Durango who were unable to agree on a matter of mine policy or management. There are, however, a number of these societies, usually the smaller ones, which are carrying on quietly and effectively in working out their own destinies. Two examples of cooperatives said to be successful are those of El Rosario and of the Compania Minera Dos Carlos. It is to serious workers like these that the government must look for real social progress if it is to come at all.

Patio retaining walls of Rayas General shaft, Guanajuato, Mexico

It is true that under the regime of Porfirio Diaz, mining flourished in unmolested vigor and metals and minerals representing enormous sums of money were taken from the soil of Mexico. Peace for the mining companies was guaranteed at a price paid to those in power which enabled them to live in luxury. The people of Mexico, on the other hand, worked harder and longer than they ever had before or have since, and Mexico as a whole received less for its efforts. Not more than a thousand men owned all Mexico, and the rest of the people were little better than slaves. Naturally, when these people were freed and encouraged to take their share of the country's resources, they wanted all they could get and even more. Strikes, impossible labor laws, crushing taxes—all were symptoms of the suddenly released energy of a people seeking the fullest extension of their new freedom.

The results are only too apparent in any recent survey of Mexican mining. Production in all branches dropped sharply when mines, railroads, and oil wells were closed by incessant strikes, and taxes, piled upon costs already high, proved the last straw for dozens of small "marginal" mines. Read the Mexican news columns of any mining magazine for the past few years and one finds a long record of industrial strife rather than indications of progress. On the one hand were the owners and managers, faced with rising costs and taxes, desirous of keeping their companies solvent and reluctant to yield to the steadily increasing demands of labor; on the other were the workmen, unused to the strength of their newly formed unions, and full of the unaccustomed and largely impractical socialistic ideals taught them by their new leaders.

Both sides have found compromise necessary, since neither has yet found a way to get along without the other. The new government of Mexico recognizes the merits and faults of both sides of this industrial warfare and is determined to work out a system compatible with democratic principles which will yet encourage the highest industrial progress. The old order of unrestricted exploitation of Mexico's resources for the enrichment of foreign capitalists is gone. The new attitude has been well expressed, for all of Latin America as well as Mexico, by Luis Quintanilla, Minister Plenipotentiary and Counselor of the Mexican Embassy in Washington. Writing in the *Atlantic Monthly* for July, 1942, he says:

"Experience has taught us to fear absentee capitalism. We do not want great sums of money invested from distant foreign markets by one powerful monopoly, but numerous small investments placed by people directly and personally interested in the country that will provide them with the means of living. We need people who, for instance, would come to Mexico with five, ten, or fifteen thousand dollars each, determined to make of their investment a human and not a market experience, a wholesome venture involving not only their pocket-books but also their brains and their hearts."

Contained in this statement is the substance of the vast difference between the colonial attitude which built the United States and that which characterized Latin America. To the former came men who intended to stay, who cut all ties with their homelands and devoted "their pocket-books, their brains, and their hearts" to the development of their new country. To the latter have come, beginning with the *conquistadores,* a long procession of men with but one thought—to make money rapidly and to return with their profits to the lands of their origin. So long as this situation is maintained, true democracy in Latin America is unattainable.

These matters have been touched upon here because an appreciation of the Mexican viewpoint is necessary before one can comprehend the forces at work in the Mexican mining industry today. Briefly, the government has now the task of eliminating the more radical and uncontrolled elements in the program of social reform to which it is committed, without returning to the monopolistic attitudes of former administrations. Assurances have been given to mining operators—Greene-Cananea for example—that they may expect a cessation of labor difficulties; decisions of the courts and of various boards no longer almost automatically favor labor, and a stabilization of taxes is planned which will enable long-range planning on the part of investors in Mexican mining.

Of course, the war has been a tremendous stimulant to this process of unification and stabilization. The government is doing all in its power to encourage the production of strategic minerals by organizing and assisting small mining enterprises, by insuring labor peace through a series of temporary contracts, by relaxing restrictions on immigration of technical experts, and by the initiation of a program of road building and railroad development which will open new mining districts now idle because of transportation difficulties. That the government is in earnest in this attempt was shown on July 23, 1942, when a decree was announced by President Camacho exempting from taxation all new investment in the mining of strategic minerals.

The chief need of Mexican mining, as it is in all industry today, is for the materials of production. All manner of mining equipment is urgently needed as well as steel rails, locomotives, and rolling stock for the expansion of Mexico's railroads. Because of her predominant position in world, as well as Hemisphere affairs, the United States is looked to by Mexico for assistance in this time of trial. Eduardo Villasenor, Director General of the Bank of Mexico, was quoted by Mr. Quintanilla as having written, "I think the future of the United States is irrevocably linked to that of Latin America. It is up to them whether they want to be linked to a poor Latin America or to a rich Latin America."

Mexico asks financial aid, but more than that she hopes for understanding and cooperation in her struggle for an improved way of life. Numbers of economists have said that only by raising the standard of living of the people of all the component nations can a thriving, mutually profitable Pan-American trade be built up. Mexico has the resources and the man-power to play her part in this task; she needs only cooperative and sympathetic instruction in the best use of these elements, and for these she looks to the United States.

Shipment of 1,000,000 oz. of silver from Monterrey refinery of American Metal Co.

ARGENTINA

Mineral industry expanding as result of domestic demand for raw materials and world-wide need for strategic metals

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MINING ACTIVITIES in Argentina have evolved in different ways during the last two centuries, following the general trend of the political and economic conditions prevailing in the country. There are many examples of work done by the Incas in times previous to the colonization by the Spaniards, particularly for gold and silver in the mountain ranges near Bolivia and Chile. During the colonization, the exploitation of silver ores was increased, as the metal was used for currency. After independence was gained in 1816, many new districts were discovered and a great increase in mining activity became apparent.

Since the beginning of the twentieth century, mining has traversed many phases—for example, periods of decay in which the recollection of past failures and the better opportunities offered in other activities—chiefly agriculture, the breeding of cattle, and land investment—drew initiative and interest away from mining. It is only in the last decade that a steady and ever-increasing progress in mining has taken place, and there are yet vast regions of the country practically virgin of systematic exploration.

There is at present a spreading sense of greater confidence and more understanding of the requirements of a mining enterprise, in spite of the lack of engineers and technical advice. Year after year the figures of production have been higher, many new mineral deposits have been discovered, the work in abandoned mines has been resumed, and various new concentrating plants have been installed. The increasing demand of local industry for raw materials, and world-wide strategic metal requirements, have encouraged the search for new sources of supply.

The total value of mining production in 1939 and 1940—not including petroleum, natural gas, and cement, which occupy a most important place in our mining activities—amounted to $14,061,000 and $15,278,000, respectively.

Metallic Minerals—Among the many substances composing this mineral output, metallic mineral production has been outstanding. In 1940, 115,047 tons, valued at $6,326,300, have been produced. These figures are based on valuation at the shipping point; they show an increase of 25 percent in tonnage and 3.5 percent in value over the previous year. The production of the principal metallic minerals is detailed in Table I for the four-year period from 1937 to 1940, expressed in metric tons (2,204.6 lb.). Some of these mineral products are utilized at home, but others are exported, either partly or completely, since only limited facilities are available locally for treatment, as in the case of tungsten, tin with silver, and zinc. The exportation of the principal metallic ores in the period 1938-1940 is given in Table II.

Lead and Zinc—The regular increase in the production of lead concentrates is due to demand abroad, as local demand is fully satisfied by the smelters installed in the country. The reduction of zinc concentrates is now being started in small scale, due to the lack of imported zinc, the domestic requirements being in the neighborhood of 11,000 tons yearly.

Deposits of lead and zinc, with a high silver content in some cases, are numerous in the mountain ranges of the country, and many known sources as yet undeveloped might be put into production with the aid of proper capital and technical advice. The Aguilar mine group, situated in the province of Jujuy, is by far the largest producer of lead and zinc concentrates. The former—carrying 74 percent Pb and with silver values—are smelted at Puerto Vilelas, Chaco, by the National Lead Co., and also exported. The zinc concentrates — 52 percent Zn — are partly exported, the rest being accumulated at the mine.

The Aguilar group alone produced more than 85 percent of the total concentrates of lead. Several other mines are active in the provinces of Jujuy, La Rioja, Salta, and San Juan, and in the territory of Neuquen. Serious exploratory work is also being conducted in a promising lead deposit found in the territory of Chubut, in the vicinity of Fontana Lake.

Export of zinc concentrates was doubled during 1941 in relation to 1940. Lead concentrates shipped had an average silver content of 1,400 g. per ton. Local production of pig lead was 11,248 tons in 1939, and 12,864 tons in 1940. Pure silver obtained in the country—almost entirely from lead concentrates from the Aguilar mine—was 568,662 oz. in 1939 and 517,612 oz. in 1940.

Tin and Silver-Tin — Although Argentina possessed the first smelter

Table I—Metallic Mineral Production

Minerals of	1937	1938	1939	1940
	Metric Tons			
Beryllium	260	753	299	520
Bismuth	19	13	6	20
Copper	55	128	12	35
Gold (in ounces)	10,449	8,423	12,249	10,322
Manganese	606	437	651	710
Lead	20,469	31,848	40,275	40,905
Silver and tin	1,487	1,529	1,402	1,342
Tin	1,665	2,385	2,170	1,667
Titaniferous magnetite	.....	2,365	3,588	2,500
Vanadium	.....	.....	431	35
Wolfram	764	1,054	1,155	1,250
Zinc	12,000	29,496	42,262	66,384

Table II—Metallic Mineral Exports

	1938	1939	1940
	Metric Tons		
Concentrates of silver and tin	1,610	1,094	1,388
Antimony concentrates	.....	200	52
Beryllium concentrates	730	286	395
Lead concentrates	20,827	21,722	27,355
Vanadium concentrates	.....	74	22
Wolfram (tungsten) concentrates	1,039	1,187	1,216
Zinc concentrates	4,467	3,959	18,245

for tin ore in America, tin mining acquired importance only recently, with the discovery of the alluvial deposits at Pirquitas, Province of Jujuy, in 1930, and later with the finding of silver-tin veins in the nearby region. The production of tin concentrates is almost exclusively confined to the Province of Jujuy, but occasional shipments come from the Province of Catamarca, where old mines of cassiterite are worked.

The richest part of the Pirquitas placer (13½ lb. of 60 percent Sn concentrates per cubic yard) has already been exploited, and the company is now using a new portable plant to work in other zones with much lower tin content (averaging 1¾ lb. per cubic yard). As shown in Table I, the highest production of tin concentrates was reached in 1938 and the present output does not cover the domestic demands. Furthermore, the prospects are that an increase of production could be possible only with exploitation of placers in other mining properties.

No figures are given for 1941, as official data are incomplete. There was, however, a substantial increase in the output of these minerals, with the exception of lead, tin, and silver.

The production of pig tin was started in 1933, and it amounted to 1,110 tons in 1938, 7,097 tons in 1939, and 895 tons in 1940. During 1941, some of the concentrates of silver and tin were also smelted in this plant, and 780 tons of pig tin were obtained thereby.

The veins, a short distance above the Pirquitas placer, have been found in contact with phyllite schists and slates in a brecciated form. In these the ore is found in irregular oreshoots, the tin as microcrystalline cassiterite, associated with quartz. For the most part the silver is in the form of cerargyrite and some sulphides. The following tonnage of concentrates of silver and tin were produced by means of a modern flotation plant: 1938, 1,529 metric tons; 1939, 1,402; 1940, 1,342.

Tungsten—During the past seven years, after a prolonged period of complete abandonment, deposits of wolfram and scheelite were again being worked on a small scale, there being an ample margin for increasing their production, particularly by means of mechanization and proper concentration plants. Production of concentrates, with a minimum of 65 percent WO_3 was shown before, but it is interesting to note that the already computed figures for 1941 denote an increase of 20 percent over those for the preceding year, totaling some 1,600 tons.

Tungsten ore output is now in a proportion of two parts of wolframite to one part of scheelite. The largest production of wolframite comes from the Condores mine, in the province of San Luis, where many other mines are working on an increasing scale. This rich deposit consists of a system of four veins more or less parallel and vertical, bedded in crystalline schists, which outcrop over a considerable distance. These veins vary in width from a few inches up to 7 ft.; and in addition to the wolframite and scheelite they contain pyrite, chalcopyrite, and bismuth, in a gangue of quartz and mica. The capacity of the plant installed at the mine is 300 tons per day. Average content of WO_3 is about 0.7 percent.

There are also a number of mines now producing tungsten in the provinces of Cordoba, San Juan, Catamarca, Mendoza, and La Rioja, so that, in all probability, the output of tungsten concentrates will reach for the current year about 2,000 tons. This production is all engaged to be sold in the U.S.A., under a three-year contract which began in November, 1941, and steadily increasing output is expected.

Manganese—Mining of manganese ores from deposits located in northern Cordoba and in southern Santiago del Estero satisfies only local requirements. The production for 1941 shows an increase of 110 percent in comparison with the figure already furnished for 1940. The greater part of this production is hand-picked psilomelane carrying about 35 to 38 percent Mn. There are also small deposits of pyrolusite carrying 42 to 75 percent Mn. Attempts are being made to obtain a higher-grade concentrate for shipment to the U.S.A., although the cost of maritime freight from Buenos Aires and the present lack of shipping space render this difficult.

Beryllium—Exploitation of beryl ore was initiated about 1932, but thus far the production of this mineral has been small. The chief sources are superficial pegmatite deposits located in the San Luis and the Cordoba hills, and minor amounts of beryllium developed as a byproduct in the mines of feldspar and mica. Although the price of the beryl does not permit deep workings economically, there are some rich deposits which have yielded several hundred tons. The quality of this beryl is good, and by hand picking, a product with 1 to 11 percent BeO is obtained. The output for 1941 trebled that of 1940 (520 tons) and most of it went to the United States. There is a local plant for the preparation of beryllium oxide (95 to 99 percent purity), which may absorb most of the beryl production of the country, and arrangements have been made to sell this product to the U.S.A. On the other hand, the irregularity of the deposits makes it difficult to forecast the future output of this mineral.

Antimony — Antimony producing zones are found in the provinces of Jujuy and La Rioja and the territory of Los Andes. Exports were 52 tons in 1940 and 150 tons in 1941, the last being consigned to England. These exported concentrates were exclusively oxides with an average content of 30 grams of gold per ton.

There are two small antimony ore smelters in the province of Buenos Aires, which treat, in addition to the local output, ores imported from Bolivia, as the domestic ore production is not sufficient to cover internal requirements. This production of anti-

Mill of Cia. Minera Aguilar, province of Jujuy, Argentina's largest lead and zinc producer

Table III—Non-metallic Mineral Production

Substance	Metric Tons 1938	1939	1940
Baryte	.....	768	2,680
Borates	6,704	12,134	8,728
Cement	1,160,706	1,127,608	1,082,279
Clays (including kaolin)	12,877	25,984	107,451
Common salt	264,150	303,321	292,307
Feldspar	620	1,051	1,220
Fuller's earth	7,594	9,894	11,737
Granite	1,393,463	1,475,887	1,752,579
Graphite	28	.....	100
Gravel	677,522	880,658	786,057
Gypsum	70,813	82,378	73,854
Lime	326,286	328,248	334,000
Limestone	264,950	247,305	180,000
Marble	8,700	10,561	13,524
Mica	250	298	292
Ochre	345	457	343
Quartz	7,442	8,617	15,927
Quartzites and sandstone	283,055	99,849	266,212
Raphaelite (asphaltite)	709	2,794	11,044
Refractory clays	1,932	1,527	22,831
Sand	1,034,000	1,288,479	2,047,849
Sodium sulphate	1,841	4,851	3,972
Talc	80	303	1,168

mony in slabs was 171 tons in 1940, of which 93 tons came from Argentina ores. A small tonnage of metal is also derived as a byproduct from the imported Bolivian lead ores (lump galena) used at the Puerto Vilelas smelter.

Copper—The largest mining installations and investments known in Argentina at the beginning of the century were made on copper deposits, but they were shut down prior to 1922, and only recently has copper production begun once more. Because of local demand for copper, the exportation of the metal and copper ores or concentrates has been controlled since 1939.

A small tonnage of cement copper is being produced by the treatment of mine waters in the Capillitas district (province of Catamarca). In 1940, 24 tons with 73 percent Cu were recovered. Chalcopyrite is mined in San Juan, and chalcocite in Salta and Neuquen—all in small quantities. Copper matte is also obtained as a secondary product in the smelting of mixed concentrates of lead and zinc at Puerto Vilelas. Forty tons with 38.7 percent Cu were produced in this way in 1940. Finally, concentrates of gold and copper, from El Oro mine, in La Rioja, are regularly exported for treatment in the U.S.A. There is no doubt that, before long, processing of copper ores will be possible in the country, as there exist many known deposits to supply the ore and no less desire to conduct such operations.

Vanadium—This element occurs in the form of vanadinite in the Province of Mendoza, and also vanadinite, descloizite, and brackebushite in the Guaico district of the Province of Cordoba. In many asphaltites, as well as in some coals and oils of the country, V_2O_5 is present, their ashes rendering as much as 50 percent of this oxide. Mining activities have been, however, superficial up to the present. Production for 1941 was 191 tons of vanadinite with an average content of 8 percent V_2O_5.

Iron Ore—A large number of iron ore mines are known, but the relatively small size and remoteness of the deposits, and the lack of adequate fuels (coke), have conspired against the foundation of a local steel industry based on the reduction of the ore. Studies are being now conducted by the Government on the Zapla district (Province of Jujuy), where lies one of the largest iron ore deposits known in the country.

Some beach sands of the Province of Buenos Aires contain high percentage of magnetite with a content of ilmenite. These supply the small quantities of iron ore which are now being produced—2,500 tons for 1940 and 3,750 tons for 1941. This concentrate, with 50 to 60 percent Fe and 10 to 15 percent TiO_2, was used by the cement industry as a flux. It is interesting to note that the average TiO_2 content of some of these sands is about 1 percent, its proportion to the Fe content being from $\frac{1}{4}$ to 1/7.

Argentina has many establishments where steel is made from local scrap and imported pig iron, but, as in the case of copper, attempts are now being made to organize a national steel plant to use local ores, even if it be on a small scale and uneconomical at first.

Bismuth—Bismuth ore is present in tungsten mines, where it is obtained mostly as the native metal. Bismuthine occurs also at some other mines. Its production during 1941 amounted to only 20 tons, which were used locally for the production of salts.

Other Metals—Small deposits of chromite, found in the Province of Cordoba, produced 60 tons of ore in 1941. Spodumene, tantalite and columbite, and molybdenite are found occasionally, all destined for exportation to the U.S.A. Also small veins of nickel and cobalt are known, as well as a deposit carrying uranium ores.

Gold—Although gold is not an essential material, a few words must be said about its production in Argentina, since conditions are favorable for future development of gold mining. Until a few years ago, most of the gold output came from the gold placers scattered all along the Andes ranges and from the southern shores of the territories of Santa Cruz and Tierra del Fuego. Recently lode mining was begun, and at present the gold output from this source represents 65 to 70 percent of the yearly production. Placer mining is done by rudimentary means, although various attempts at dredging were undertaken 30 to 40 years ago. The present value of gold, and the modern methods and machinery available for its concentration, lend solid possibilities for the exploitation of many mines and prospects which were abandoned years ago, and there is a vast field for the introduction of more mechanized equipment in placer work.

Figures of the gold output during 1941 are not yet completed, but one may estimate an increase of 30 percent over the record for 1940, mostly due to the production from El Oro mine, in the Province of La Rioja. The total production may be estimated at 410 kg. of fine gold, or 13,183 oz., but, small as it is, there is no doubt that it will increase in the future.

Non-metallic Minerals, Rocks, and Other Products—Production of these substances continues to increase along with the rapid development of various industries within the country. Among the non-metallic minerals, common salt, gypsum, borax, and sodium sulphate have been outstanding. The production of common salt, which is obtained from the various salt beds in several provinces and territories, grows constantly, and the rock salt obtained in the territories of Neuquen and Los Andes has completely replaced a tonnage that was formerly imported. The borate fields (borax, ulexite, etc.) have again come into production, after a

Prospecting for asphalt near Santa Marta in the territory of Neuquen

long period of quiescence, in order to supply a strong demand from abroad. Other minerals produced in excess of the domestic necessities are quartz, feldspar, and mica, found in numerous pegmatite deposits distributed principally in the provinces of Cordoba and San Luis. Also fluorspar, asphaltite, graphite, baryte, kaolin, clays, and other products are being exploited on a larger scale, as shown in Table III.

As indicated by these statistics, Argentina produces a great variety of non-metallic substances, and the indication is that the list in the foregoing paragraph will be enlarged. New sulphur and coal deposits are now being worked, and increased production is expected of some already known deposits such as those of mica, clays, kaolin, barytes, and aluminum sulphates. These products represent the raw material utilized in local industries at a constantly increasing rate.

Mica is, by far, the most important non-metallic mineral being exported nowadays. The major producing center is the Province of Cordoba; then follow Catamarca (ruby mica), San Juan, San Luis, and La Rioja. Production of mica increased 45 percent in 1941, amounting to about 420 tons, of which 386 tons were exported. Other exports of non-metallic minerals are shown in Table IV.

Table IV—
Non-metallic Mineral Export

	(In Metric Tons) 1940	1941
Marble and aragonite (onyx)	934	2,056
Fluorspar	135	180
Asphaltite	2,158	1,768
Borates	6,399	10,076
Gypsum	6,426	6,477
Salt (NaCl)	30,574	57,670

Mining Laws and Taxes—There is a general mining code applied in all the nation, either by the federal government in the territories or by the several provincial governments. This basic law grants the concession of prospecting or exploration permits in units that may cover up to 2,000 hectares (4,942 acres) and for a maximum period of 300 days. In addition, any person may start a mining claim, even without a previous permit for exploration, by simply recording discovery of any given mineral.

Mineral substances are classified in three different categories: first, all of the metals and fluid or solid fuels; second, metalliferous sands and gravels (placers), salt deposits borates, sulphur, kaolin, clays, and graphite; third, building materials such as granite, lime, or marble which are mined by quarrying. Minerals of the first category are independent of the soil or surface property; concession in this class can be given only by the State (Federal or Provincial). Each claim covers 6 to 9 hectares (15 to 22.5 acres) for metals, and up to 81 hectares for coal, depending on the position of the deposit. There is a special law for oil concessions, with different areas and fees. The number of claims for a single mine may be up to seven, but no limitation exists as to the number of mines to be held by one person or company.

For the substances of the second category, there is the typical unit claim or *pertenencia* of 6 hectares. Gold washing or placer mining is free to individuals, but when proper exploitation of a river bed is desired, *pertenencias* of 10 hectares each are granted in the necessary number to cover the workable area. For salty deposits and borates, each *pertenencia* covers 100 hectares (247 acres). Finally, for peat and rock salts the area for each unit is 20 hectares. For some of these substances of the second group, the owner of the surface land has preference in obtaining mining rights in case he wishes to exploit them. Minerals of the third category (quarries) belong to the owner of the land, who can dispose of them at will.

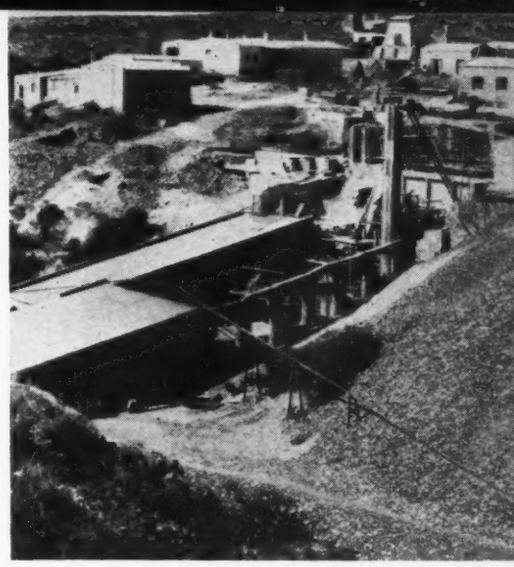
As to mining fee and other regulations, they are quite liberal. Only 8 pesos[1] for the exploration permit, 100 pesos a year per mining unit or *pertenencia* for minerals of the first category, and 50 pesos a year for those of the second. The official survey of the claims must be paid for by the applicant within 350 days after the registry of the claim. Also a minimum investment in mining work and plant is required within the first four years of the concession. In one province a 2 percent tax is levied on mining products, but no other mining tax is in force in the country. General taxes on the earnings of all sorts of enterprises and activities in Argentina are at present much lower than in the U.S.A.

Present Needs and Further Development of the Mining Industry in Argentina

As only a brief review of these conditions is possible within the limitations of this article, attention shall be given to the more important aspects related to mining in the country.

There is a great lack of technical personnel in Argentina who are familiar with typical mining problems. Graduate engineers cover only the classical branches—civil, mechanical, electrical and hydraulic—and it is only two years ago that the Universidad de Cuyo, in the Province of San Juan, has offered a course for mining engineers. This deficiency is naturally a great handicap for rapid development of the mining industry, and most of the important concerns are dependent on bringing their own experts from abroad. On the other hand, trained personnel for general work is available, as is shown by the numerous factories and shops which are directed by Argentine engineers. Much is to be gained by the presence in the country of North American mining engineers, and some steps are being taken officially to bring two or three experts from the U.S.A. to assist further mining activities.

[1] 1 peso = $0.238 U. S. at time of writing.

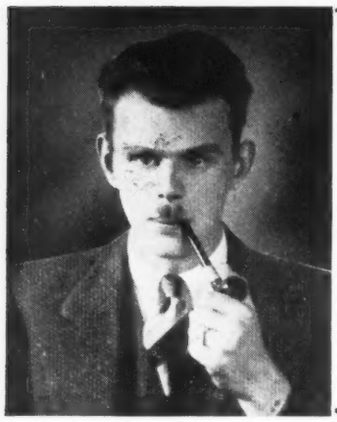


Los Condores tungsten mine in San Luis, largest in Argentina, treats 300 tons daily

The fact that there are in the country less than 15 mining plants deserving the name of medium- or large-scale enterprises indicates that there is much to be done in modernizing or enlarging many mines. Although most of this equipment will have to be imported from the U.S.A., much of it can be made locally in the many plants capable of manufacturing the accessory machinery necessary to any given industry.

Argentina capital has been somewhat reluctant to enter mining investments, but the position has changed nowadays, due to the relative diminution in earnings derived from the traditional economic sources. Furthermore, the amount of foreign capital locked in the country as a consequence of European conditions is very large, and no doubt a part of this fund will be directed to mining enterprises. North American capital is already the leading source of the more important investments in mining; for example, in the largest lead and zinc, tungsten, and gold deposits. It is reasonable to expect that these interests already established in the country will develop further activities, resulting directly or indirectly in new mining exploitations.

The fact must be borne in mind, then, that mining possibilities in Argentina have a field of development based mainly on national needs, due to the present difficulties of importing numerous minerals or metals which were formerly brought into the country. Furthermore, there is also the prospect of increasing or starting the production of those minerals essential to the war effort, which can be exported to the U.S.A.



ECUADOR

Increasing demand for strategic metals will aid development of mineral economy, which is now subordinate to agriculture

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ECUADOR'S two principal sources of national income are agriculture and mining. For the moment agriculture is in a predominant position, but already there are indications that mining will again play a prominent rôle in the nation's economy in the not too distant future. It is not out of the realm of probability that the ever-increasing demand for strategic minerals on the part of the United States may accelerate the tempo of this development. Indications such as a steadily reviving interest in new prospects and older inactive mines, and a general tendency to decrease gold and silver production in favor of opening up copper, lead, zinc, and other non-ferrous metal mines, are noticeable in the different mining centers of the country.

Mining in Ecuador is said to have commenced before the Inca conquest, which occurred around 1470, and development was gradually increased by both the Inca owners and the Spanish *conquistadores* succeeding them. After the passing of the original *conquistadores* and their immediate descendants, mining activities declined and many workings were abandoned and forgotten. Development came practically to a standstill during the seventeenth and eighteenth centuries. The reasons for this inactivity are to be found in the then existing political instability, absence of transportation facilities, and very high interest rates on borrowed capital. The last-named factor is plaguing the country even today, for minimum yearly interest charges are 12 percent. In addition, local banks are too small to finance a mine even of moderate size.

A moderate revival of mining was brought about some 46 years ago, when South American Development Co. brought into production the Portovelo gold mine, in the southern part of the republic, and the oil fields on the Santa Elena peninsula were developed. Since then interest in mining has continued and some foreign capital has entered, with the result that nine oil companies are active, mostly on exploratory work, and gold production has been expanded by foreign concerns. The Macuchi mine, placed on a production basis recently by Cotopaxi Exploration Co., is the second largest gold producer in Ecuador. Monthly production of the republic's important gold mines is given in the accompanying table. In Oriente, the eastern section of Ecuador, Scarloch Mining Corp. has installed a washing plant on the Anzu River to test existing placer deposits.

Geologically, Ecuador may be divided into six distinct provinces—namely (1) the Coastal Plain, (2) the Western Andes, (3) Central Andean Valley, (4) Eastern Andes, (5) Third Cordillera, and (6) the Upper Amazonas and Fourth Cordillera. The Coastal Plain covers the provinces of Guayas, Manabi, and Esmeraldas. Some parts of the region are arid, but in the north and along the Andean foothills dense tropical forests, from which rubber and many types of wood are exported, prevail. Sediments from Pleistocene down to and including Cretaceous, and possibly still lower formations, are exposed. Volcanic activity seems to have ended shortly before the Cretaceous, because no beds lower than the Cretaceous have been found deposited on the volcanic agglomerates. Intrusives are exposed in all of the three provinces mentioned previously. Rocks are basic. The Miocene sedimentary rocks contain fragments of andesite, quartz diorites, and other acidic rocks, suggesting that

the western Andes were in their first period of formation during this epoch. Some platinum- and osmium-bearing sands are found in Esmeraldas. Gold placers are quite common, but the deposits in general are too spotty to warrant exploitation on a commercial scale. The ocean beaches between the towns of Esmeraldas and Manta are composed of black sands, with the black constituent being magnetite, probably derived from the extremely ferruginous, coarse-grained sandstones which are or previously have been exposed to wave action. In the Mompicha-Cojimies area, almost on the border of the provinces of Esmeraldas and Manabi, quantities of high-grade coal are frequently washed ashore. From the size of the blocks, which at times weigh more than 250 lb., it is judged that the submarine exposed bed is nearly 90 cm. thick. Further investigation will have to be done by core drilling. Apart from the washed-out magnetite mentioned, there is a hematite deposit (Fe_2O_3, 98.9 percent) at Pascuales, north of Guayaquil.

The Western Andes border to the west on the Coastal Plain and to the east on the Central Andean Valley. The age of this mountain range is believed to be Eocene or Miocene. It is covered on the west by older sediments, probably of Lias or Trias age, which closely resemble those of the same age exposed in the Oriente region, in the vicinity of Mendez and Macas, and in the Rio Hollin (lower redbeds). In the Western Andes they have a crumpled appearance, suggesting they might have been thrust over instead of deposited *in situ*. On the east the complex is covered by volcanic sediments and lava flows. The main body consists of intermediate to basic rocks, grading into more acidic ones extending south. Free quartz is present in relatively small veins intruded in diabasic rocks and the like, always, however, of a more basic character than the corresponding groups in the Eastern Andes. In this complex a nearly continuous vein system of sulphide ores, mostly gold- and silver-bearing, runs north-south, with a pronounced irregularity in the south. This line follows approximately the 2,000 to 2,500 topographical contour. The mines of Macuchi and Molleturo are situated on this mineralized zone, known as the Western Mother Lode.

The Central Andean Valley is completely covered by intrusives. A volcanic decomposed tuff, known as "Cangagua," is extensively used in the production of adobes for building purposes. Several localities, among them those near Latacunga and Ambato, yield "pishilata," an agglomerate of pumice stone and volcanic ashes, which is easily worked by hand and also used in building. North of Quito, at Nono, oil is encountered in small but commercial quantities. No satisfactory explanation has been advanced yet as to the occurrence of oil in this volcanic region. Immediately south of Quito many mineral water springs are found, some of high temperature. Near Latacunga is a spring containing a considerable amount of lithium. North of Quito manganese ores are exposed, but the deposit has not been sufficiently investigated as yet, and it is doubtful whether the tonnage contained is large enough to warrant installation of mechanical equipment. Zones of main volcanic activity occur on both sides to the west and towards the east of the Central Andean Valley. Although volcanism has by no means ended, it may be assumed that the height of activity has passed. The famous Cotopaxi, the 5,943-m. colossus, covered permanently with snow, is in the eastern volcanic belt.

The Eastern Andes are comparatively unknown, owing to inaccessibility. These mountains rise to some 13,000 ft., with the higher peaks reaching 18,000 and 19,000 ft., and are the first barriers encountered by the moist winds from the Amazon area. As a consequence, the eastern slopes are covered by dense forests. There are three or four mule trails connecting the upper Amazon plain with Quito, Ambato, and Riobamba, respectively. The Ambato-Baños-Puyo trail has been partly widened into a good automobile road, with completion expected sometime next year. The mountain range discussed is highly complex in composition. Basaltic and andesitic lava flows over old gneisses and schists and to the east the massive is abruptly cut off by a valley in which sedimentary rocks are exposed, probably of Cretaceous to Triassic age. My personal opinion, which, however, is based on comparison with similar rock formations in Colombia and Venezuela rather than on studies of the localities in question, is that the gneisses and schists may belong to the ancient Gondwana massive and consequently must be of carboniferous age. On the western slopes of the Baeza Valley, north of the village of Baeza, coal has been found. Owing to its remote locality, the deposit has never been adequately studied, nor the age of the coal determined. There are evidences that sulphide ore veins similar to those contained in the Western Andes may be found in the region, known as the Eastern Mother Lode. However, as only a few localities are known, intensive study of the region is necessary. The same characteristics as those present in the Western Mother Lode seem to prevail—namely, that lead and companion metals predominate in the south, and copper and related metals in the north. Gold and silver are also found.

The Third Cordillera consists of a series of batholiths. The average altitude of this mountain range is about 9,000 ft. The region is covered by jungle and cut by deep creeks. The age of the range may be considered to be Eocene—possibly Miocene. It is several hundred miles in length, and is composed mainly of acidic rocks, the greater part being granite. The granite in many places is in contact with the limestone and Cretaceous beds exposed in the broad geosyncline of the Amazonas. All rivers flowing east from this massive are gold-bearing, as are those flowing west and north, as for instance the Cosanga and Quijos rivers and others. Whether this gold originates in the Third Cordillera or from banks of ancient river beds has not been established. No gold veins have been discovered to date in the Third Cordillera. Along the eastern limit oil seepages occur.

The extreme eastern region, the Upper Amazonas, sloping from an altitude of about 1,500 ft. down to 800 ft., consists chiefly of sedimentary rocks. South of Napo, along the Anzu River, the Scarloch Mining Corp. worked a sedimentary gold deposit which now has been abandoned. Near Zamora in the extreme south, several gold concessions are being explored. Many of the gold-bearing rivers are being washed by Indian tribes, the yield being sold at trading posts estab-

Monthly Production of Ecuador's Most Important Gold and Silver Producers

	Portovelo Mine		Macuchi Mine	
1940	Gold in Troy Ounces	Silver in Troy Ounces	Gold in Troy Ounces	Silver in Troy Ounces
Jan.	4,305	9,203		
Febr.	4,597	8,402		
March	4,310	8,044	From February to June:	
April	4,510	7,859		
May	4,514	6,927		
June	4,153	7,223	6,185	36,111
July	3,978	5,971	1,796	6,496
Aug.	3,983	5,625	2,097	6,219
Sept.	4,009	5,978	2,071	10,183
Oct.	4,217	5,049	2,673	12,842
Nov.	4,614	5,389	2,393	9,680
Dec.	4,845	6,457	1,967	8,634
1941				
Jan.	3,834	5,101	2,078	10,651
Febr.	500	227	2,366	11,265
March	4,808	7,804	3,612	18,006
April	5,417	8,357	2,641	15,710
May	4,866	9,248	3,425	19,689
June	4,482	8,212	2,423	14,007
Yearly production, 1940	52.035	82.127	19.182	90.166
First semester, 1941	23.008	38.950	16.546	89.329

Taken from "La Mineria y el Petróleo en el Ecuador" 1941. By Enrique Coloma Silva, Director Gral de Mineria y Petróleos.

lished along the main rivers. Gold of 22 to 23 carats is obtained from the Payamino River. At times very small rubies are found in the washed gold. The entire eastern region is held in concession by the Shell Company of Ecuador, Ltd., and exploration for oil has been in progress for about four years. The production stage is expected to be reached late in 1942. Due east of Napo there is a hill running parallel with the Third Cordillera. This range may be considered as a not fully developed Fourth Cordillera. The igneous is not exposed through the cover of sedimentary rocks, but many dikes may be observed on the surface. The isogonic chart of the Oriente shows a striking irregularity near this Cordillera, which is also called Cordillera de Galeras. Separated from the main volcanic center peaks in the area, immediately north of the Galeras, is the Sumaco volcano, which has been studied in some detail by Sinclair and Wasson, and is described in their monograph (*A Journal of Science,* Vol. XVI, Oct. 1928).

When speaking of zones or areas of primary interest, one may distinguish two types—namely (1) proved orebodies, for one or another reason lying idle, and (2) regions where geological conditions point to the presence of mineral deposits, but no exploration has been undertaken. As the second type has been touched upon in the preceding paragraphs, the discussion to follow will be centered on the first type. The principal reason for known orebodies not being worked in Ecuador is lack of capital. The next adverse factor is the existing medieval banking situation, under which it is practically impossible to secure funds at reasonable interest rates and for a long term. Add to this higher prices for equipment and materials, the difficulty in obtaining them because of war conditions, higher transportation rates, and others, the situation of the private mine owner, especially one holding a small or medium size property, has become very unfavorable.

One of the most interesting orebodies is the Pilzhun lead-zinc-copper-gold-silver lode some 20 km. distant from the Guayaquil-Cuenca R. R. in the Eastern Andes, and probably a part of the Eastern Mother Lode. The ore assays 40 oz. silver, 12 percent zinc, 9 percent lead, with gold not exceeding 6 grams per ton in the richest section. The deposit can be worked by open-pit methods. In the south, near Loja, a stibnite deposit has been discovered. Its extension is not known, and core drilling is indicated. As this part of the country has not been studied geologically, it is difficult to say to which of the Mother Lodes, if to either of the two, the deposit belongs. In the province of El Oro, about 6 km. east of Pasajo, a town connected by rail with Puerto Bolivar, where shipping facilities exist, a manganese deposit has been found. Though the region has been studied by several geologists, no definite information is available as to the size and tonnage contained in the deposit. The recent Ecuador-Peru incident was largely responsible for the deposit not being worked. However, as the territory containing the deposit has definitely been assigned to Ecuador by the Protocol of Rio de Janeiro, the chances for early development of the orebody are decidedly better. Immediately north and south of the Macuchi mine, operated by the Cotopaxi Exploration Co., several small concessions are held by private owners and small companies. The Isinlivi area covering some 52 sq.km. has been declared State reserve. These reserves may be obtained in concession by concerns capable of developing the property on terms previously agreed upon. The ore encountered in the Macuchi-Isinlivi area, as far as copper is concerned, is chiefly chalcopyrite, covellite, and chalcocite. Ore treated at Macuchi contains about 90 lb. of copper per ton. As will be seen in the table, gold and silver production is considerable. Lead is available in the Molleturo-Gualleturo region. The mines have been worked by the Spanish, principally because of high silver values. The region is promising, and a thorough study should be made to determine its tectonic history.

In Ecuador, two types of concessions may be obtained—namely (1) concessions by denouncement, and (2) concessions by contract. Maximum extension for concessions by denouncement is 20 *pertenencias,* each covering 10 ha. or about 25 acres. The cost is $3.30 U. S. Cy. per *pertenencia* per year. Contract concession are much cheaper (about $0.25 U. S. Cy. per sq.km. for large extensions). Generally, there is included in each contract a clause under which the company in question agrees to perform an "*obra de compensacion*" to the general benefit of the concession area for a maximum amount previously set. The work must be started as soon as the company commences exploitation. The government royalty in each of the two cases is 6 percent of the gross production. Private owners of the land do not have other than surface rights. The labor situation is good. Sufficient unskilled labor may be obtained at wages ranging from $0.30 to $0.60 U. S. Cy. per day. In the coastal zones wages are somewhat higher, chiefly because of better prices received now for forest and agricultural products. Skilled labor is scarce, but, apart from the Indians, the workers are intelligent and can easily be taught trades by proper training, as has been proved by the oil companies.

Although the current annual metal output is comparatively small—only two mines are in production—prospects for increased mining activity in Ecuador are good. The need for new roads and improved communications to make possible investigation and development of mineralized areas has been recognized by the present government, and all is done to extend and improve the country's highway system. Until recently, the Central Andean highway was the chief artery linking the central area of the republic with the coast. Several new feeder roads are now under construction, and good progress is being made on the Quito, Santo Domingo-Chone highway. Development toward the east is in progress east of Pifo, where the Baeza road has been advanced considerably toward Papallacta. The Ambato-Baños-Puyo highway is expected to be completed sometime next year.

Camp of South American Development Co., 46 year old gold mine at Portovelo, Ecuador

COLOMBIA

Systematic survey needed to determine mineral resources and stimulate search for metals other than gold

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Secretary, Colombian Miners Association,
Medellin

BECAUSE Colombia has not yet been studied sufficiently from the geological viewpoint, there is lack of information regarding the real mining resources of the country. When speaking of mining in Colombia, one nearly always has in mind gold mining, because this is the branch which has attained a real development and has been known from the time of the Spanish Conquest. Nevertheless, Colombia occupies a good position in the production of petroleum, and it also mines platinum, emeralds, coal, rock salt, limestone, iron on a small scale, and other mineral products.

Only recently has enthusiasm been aroused in our country in the discovery of the so-called base or strategic metals which may be of importance in war, such as manganese, chromium, copper, molybdenum, mercury, zinc, lead, aluminum, and tungsten. Explorations are presently being made in some of these deposits, but no systematic working is carried on. There are exported to the United States some quantities of concentrates consisting chiefly of auriferous galena or blende, which, because they are refractory, are not reduced in the interior. This is because the installation of central reduction plants, planned by the government, has not yet been completed. Small quantities of mica, galena, and asbestos have also been exported recently.

Gold mining has always been highly important to Colombia because it is largely the basis of the economy of the country and is the second largest source of revenue, being exceeded only by the coffee industry. Silver is obtained as a byproduct in the mining of gold, and the same applies to platinum, which is extracted mainly in the rich region of el Choco, near the Pacific Coast. Colombia occupies first place in the production of gold in South America. Production is given in Table I.

The total product of Colombian mining is exported to foreign countries and represents about one-third of our receipts of international exchange, which has made it possible for the country to maintain a stable rate of exchange in recent years and, besides, to service the external debt.

Table II gives an idea of the importance of gold-mining operations in Colombia and shows the modern systems of treatment as well as the rudimentary methods which are still employed, such as the so-called drag mills.

It is to be observed that production from investment of foreign capital, which is entirely of American, Canadian, or English origin, has increased considerably in recent years. In 1932

Table I—Gold and Silver Production of Colombia

Year	Gold, oz.	Silver, oz.
1931	184,274	77,709
1932	248,249	194,761
1933	298,242	108,005
1934	344,140	127,461
1935	328,991	132,965
1936	389,495	151,502
1937	442,222	176,978
1938	520,715	192,879
1939	570,017	242,627
1940	631,928	260,313
1941	656,028	271,124
1942 (Jan. to May)	261,406	110,889

it was only 35 percent and today it reaches nearly 60 percent.

Gold mining in Colombia had been expanding constantly for about ten years past, but recently there has set in a period of stability due to various causes. Principal among these are, first, the fear of capital to engage in new enterprises because of the uncertainty that exists with regard to gold, resulting from the policy of the United States, which is today, and very justly, much more interested in the strategic minerals than in gold; and second, the constantly growing difficulty in importing machinery and supplies.

In Colombia exploration for gold-bearing minerals has almost ceased and has been replaced by greater activity in the search for the base metals which today are so important for the war effort. It is true that at present apparently successful work is being carried on in the extraction and exportation of galena, blende, bauxite, chromite, mica, and other minerals, but in spite of these efforts, it cannot be said that we have today any systematic production of such material. We need capital, means of communication, and technical skill for this kind of mining, and a methodical study of our mining resources. We are potentially rich, but we do not yet know the true value of our mineral wealth.

Nevertheless, Colombia undoubtedly offers great possibilities in mining resources, and, in addition, the country has the great advantage of a stable government and a sound administrative and fiscal policy which gives guarantees and security to the investors. Its geographical position could not be better. It borders on Panama and has extensive coasts on the Atlantic and also on the Pacific Ocean.

We consider that if the search for base metals is maintained and the Colombian government, in its turn, offers greater facilities for the discovery of those minerals by revising the present concession system, the day is not far distant when Colombia will start systematic mining of manganese, copper, and other strategic minerals.

In Colombia not fewer than 80,000 persons are actively engaged in mining work and approximately half a million inhabitants live on this industry.

Accounting for 60 percent of the gold production of the country, the Department of Antioquia possesses most of the mineral wealth of Colombia. Coal is mined in Antioquia and also limestone for the manufacture of a good cement. At present it is planned to install a steel plant in the city of Medellin (the principal Colombian mining center) for the purpose of utilizing available scrap and also to smelt the iron ores (limonites) which are found in the locality. There occur outeroppings of manganese (pyrolusite) in the region of Santa Barbara; bauxite in Santa Rosa; fragments of chromite near Medellin; asbestos and mica in Yarumal; and copper in Frontino and Salgar. Some minerals of importance which exploration has indicated may be found in Colombia are discussed in the following paragraphs. Gold and silver have already been mentioned.

Table II—Summary of Gold Mining Operations in Colombia

(Estimate)

Vein mining	No.	Stamps	Tons per Day
Antioquian mills	460	2,300	1,610
Californian mills	68	480	1,300
Ball mills	12	.....	500
Drag mills	400	.....	50
3,460 x 30 = 103,800 tons per month			3,460
103,800 x 7.5 grams = 778 kg. gold per month			

Alluvial mining	No.	Cu. Yd. per Month
Dredges	17	3,100,000
Draglines	2	60,000
Hydraulic elevators	110	880,000
Monitors	400	.....
"Barequeros" (individual washers)	...	20,000
4,060,000 x 200 mg. = 812 kg. gold per month		4,060,000

Summary

	Kg. Gold per Month	Per cent
Vein mining	778	48
Alluvial mining	812	52
	1,590, or 500 oz.	100

Platinum—Colombia is one of the principal platinum producing countries, although the metal is obtained largely as a byproduct of placer gold mining. The richest region is the Intendencia del Choco, bordering on the Pacific Ocean, where nearly all the rivers and ravines of the western slope of the Cordillera are rich in platinum and gold. With platinum there are found associated, in small quantities, palladium, iridium, and osmium. Centers of platinum production have been the Atrato and San Juan rivers, as well as their tributaries, and the regions of Condoto, Iro, Tamana, and Todosito. Output of this element in recent years has been approximately 1,500 kg.

Copper—Copper ores are found in western Antioquia, in the townships of Frontino, Dabeiba, and the Sucio river; also in "Cerro Plateado," Township of Salgar. Formerly copper was mined in Moniquira, Department of Boyaca, and in Villeta and Nocaima, in Cundinamarca. Numerous indications of copper deposits are found in other states, but no one of them has yet been exploited.

Iron—Some time ago iron ores were reduced in Amaga, Department of Antioquia, and in the Valley of Medellin are found extensive deposits of lateritic iron ores originating through the decomposition of serpentine. At present iron ores are reduced in Cundinamarca and a steel plant is planned for Medellin, capital of the Department of Antioquia and principal industrial center of the country.

Deposits of iron also occur in the region of Payanda, in the Department of Tolima; in the Valley of Tenza, in Boyaca; in Cundinamarca, the Sierra Nevada, Nemocon, and La Pradera. Possibilities for the exploitation of Colombia's iron ores appear to be favorable.

Tin—Cassiterite occurs in the auriferous gravels of Ocana, in the Department of Santander, but we do not know that critical investigation or study has yet been made of these deposits.

Manganese—Deposits of pyrolusite are known to exist in the region of Santa Barbara, Antioquia. Some explorations are being carried out in Apia, Caldas. Psilomelane is found in Chaparral, Tolima, and in Pereira, Caldas.

Chromium—In the neighborhood of Medellin there exist segregations of chromite, but no serious study has been made.

Aluminum — Bauxite with good alumina content occurs near Santa

El Jobo dredge of Pato Consolidated Gold Dredging, Ltd., working along the Nechi river

Table III—Mining Enterprises of Colombia

	Department	Capital
Pato Consolidated Gold Dredging, Ltd.	Antioquia	American
Asnazu Gold Dredging, Ltd.	Valle	"
Compania Minera Choco Pacifico	Intendencia Choco	"
Compania Minera de Narino	Narino	"
International Mining Corporation	Caldas	"
Minas de Supia y Marmato	"	Colombian
Sociedad Minera El Crucero	"	"
Empresa Minera de Guayaquil	"	"
Supia Gold Dredging Ltd.	"	American
Empresa Minera de " Vendecabezas "	"	Colombian
Cuturu Gold Dredging Co.	Antioquia	American
Nechi Valley Gold Mining Co.	"	"
Frontino Gold Mines, Ltd.	"	English
Viborita Gold Mines, Ltd.	"	"
Compania Minera de Las Camelias	"	"
Timmons Ochali Mining Co.	"	Canadian
Compania Minera de San Andres	"	Colombian
Empresa Minera de Charcon	"	"
Empresa Minera de Gallinazo	"	"
Caramanta Mining Co.	"	Colombian-American
Empresa Minera La Leona	"	"
Minas de Porce y Nechi	"	Colombian
Compania Minera de Tigui	"	"
Sociedad Minera Pascualito y Buenavista	"	"
Compania de Minas Chilona S.O.	"	"
Sociedad Minera La Bartola	"	"
Empresa Minera de Carnicerias	"	"
Sociedad Minera La Clarita	"	"
Sociedad Arrendataria " El Zancudo "	"	"
Oil Companies (in Operation)		
Tropical Oil Company	Santander Sur	.....
Colombian Petroleum Company	Santander Norte	.....

Rosa de Osos, Antioquia. Nodules of the same material are found in the region of Copacabana, Antioquia, and in the Department of Tolima.

Mercury—Cinnabar occurs in the Department of Tolima, and it formerly was mined in the region of Quindio, on the Bermellon river. Native mercury is found near the town of El Chareo, on the Iscuande River, which empties into the Pacific.

Molybdenum—We have seen samples of molybdenite of good quality from the Department of Cauca and also from Antioquia and Narino, but nothing definite has been stated regarding the existence of this material.

Lead and Zinc—Zinc ores have been discovered in Gachala, Gacheta, Junin, La Palma, and Ubate, in Cundinamarca. The ore is also found in Toloma. Galena occurs in Santander, Zapatoca, and in Villa de Leiva, in Boyaca. These two minerals are very common in the gold-bearing lodes of the country and recently great interest has been aroused by their discovery.

Coal—Colombia contains plentiful supplies of coal, although its heating power is not high. However, hardly enough is mined for local consumption, and, although it may seem paradoxical, coal is imported at times from England. The natural thing would be for Colombia to furnish this material to the other countries in South America which greatly need coal. At present the possibility of exporting coal is being studied, but the great difficulty consists in the high cost of land transportation and in the rudimentary manner in which the deposits are worked.

Coal is found chiefly in Antioquia, and the deposits in this department were carefully studied by E. Grosse in his book called "El Terciario Carbonifero de Antioquia." The departments of Cundinamarca, Boyaca, el Valle, and Narino are also rich in coal.

Petroleum—Colombia produces approximately 25,000,000 bbl. per year, a little more than 10 percent of the production being consumed in the country. The oil wells are found in the interior, and the petroleum is transported by long pipe lines to the northern coast at Covenas. After Venezuela, Colombia occupies the first place in petroleum production in South America.

Mica and Asbestos—Mica is found in the departments of Antioquia, Santander, Narino, and especially in Huila, where some discoveries of importance recently appear to have been made.

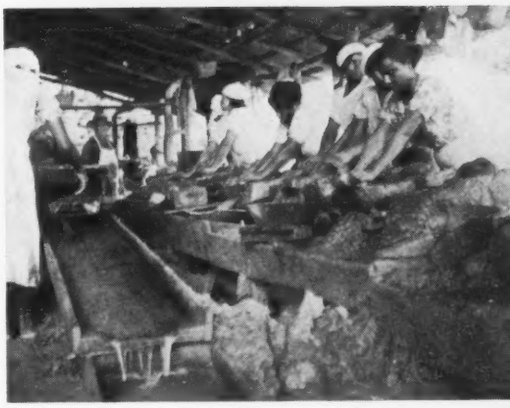
Outeroppings of asbestos occur in Campamento, Antioquia, and also in Cauca and Narino

Emeralds and Precious Stones—Colombia's position as a producer of emeralds is outstanding. Its Muzo, Cosceuz, and Chivor mines, which have become famous, are in the eastern cordillera in the Department of Boyaca. Work is at present suspended, but the government possesses beautiful specimens. An uncut precious stone was recently presented by the Colombian Army to the President of Peru, Dr. Prado, during his visit to Bogota in the month of May of this year.

In conclusion, we repeat that Colombia offers good prospects from the mining viewpoint, but for the development of base-metal production it is essential that ways of communication and access be constructed. Foreign capital should also cooperate on reasonable terms in the scientific study of the country's resources, with the certainty of being well repaid. For its part, our government offers a strong and true democratic organization and is animated with the highest spirit of collaboration and American solidarity. Thus we guarantee individual liberty and the common defense of the democracies which today are threatened by the totalitarian countries.

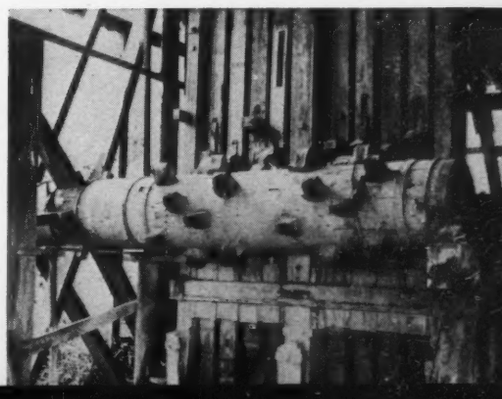
Two barequeros, placer miners, panning gold with the Colombian wooden batea

Grinding and amalgamating gold concentrates, National Mines of Marmato



Typical arrastra used in many small Colombian gold mines

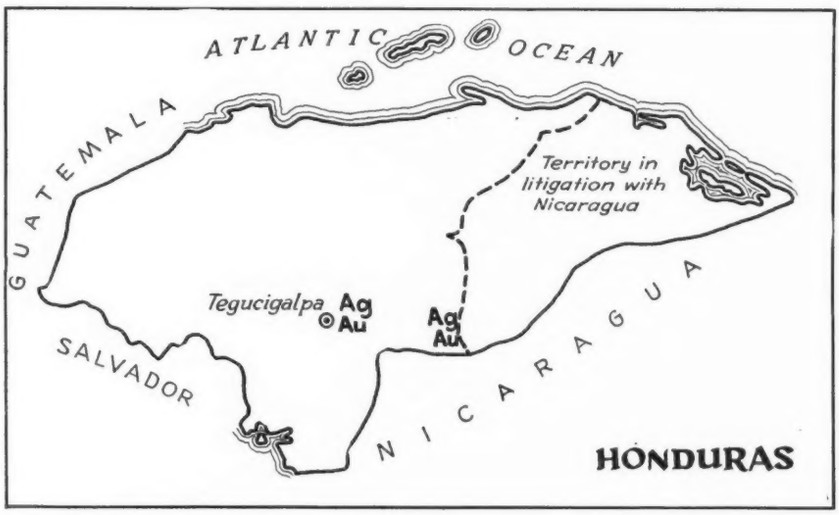
Antioqueno mill, Colombian version of the stamp mill, used for gold ores



HONDURAS

Lack of transportation limits present value of some known base-metal ore deposits. Gold holds dominant position.

K. H. Matheson
General Manager
New York & Honduras Rosario Mining Co, San Juancito



NOTWITHSTANDING irresponsible publicity as to the undeveloped mineral resources of Honduras, the fact remains that deposits of commercial importance, other than prospective reserves in the few producing gold and silver mines, are not likely to be discovered in the near future. Mineral districts are, however, widely scattered throughout the Republic, and several minerals extremely essential to the war effort can be found in them. None of these occurrences has as yet been proved to be sufficiently large to overcome the disadvantage of poor transportation facilities. More favorably situated, some of these deposits might have merit.

Two mining enterprises furnish practically the entire mineral production of Honduras today. These are the New York & Honduras Rosario Mining Co. at San Juancito, 100 miles from the Pacific Coast, and Compania Minera Agua Fria, S.A., near Danli, also about 100 miles from the coast nearer the Nicaraguan border. The former company, in continuous operation for 62 years, has a milling capacity of 550 tons per day and has produced upwards of $65,000,000 in gold and silver bullion. Nearly 3,500,000 oz. of silver and 23,000 oz. of gold were recovered in 1941.

Agua Fria mine, in operation since 1935, has been mining about 100 tons per day of gold and silver ore. Annual production from this mine has been about 12,000 oz. gold and 16,000 oz. silver, but ore reserves appear to be definitely limited.

Antimony is found in many widely scattered deposits, but the attempts made in the past to work some of them were not backed with sufficient capital to determine their possibilities. Two such deposits are being mined at present, one near the town of Yoro, and the other west of Santa Rosa de Copan. No systematic development has been effected and only small tonnages are available for the present emergency. It must be recognized that all the known antimony deposits are subjected to such severe transportation charges that only war demand and prices could make their exploitation possible. None show sufficient prospective value to invite capital for their development during normal times.

Manganese deposits are likewise widely distributed, but reputable engineers have found them to be too small for large production operations that would materially benefit the present war effort. Cuban interests are developing some manganese deposits about 20 miles east of Pespire within 35 miles of the sea. Production to date has been negligible, with scant signs of improvement.

Mercury is found in the vicinity of Talanga, 130 miles from the Pacific Coast, but underground development of this property a few years ago failed to discover workable quantities of the metal. Copper mineralization has been found scattered all over the western and northwestern sections of Honduras, but all ore concentrations discovered to

Camp and mine buildings of New York & Honduras Rosario Mining Co., a gold and silver producer for 62 years

date have been of too low grade or too small to justify exploitation. No chrome, nickel, or tin deposits have as yet been discovered.

Honduras does have one mineral asset in the Agalteca iron mountain, a high-grade iron-ore deposit said to contain between 20,000,000 and 30,000,000 tons. Limited shaft and tunnel work indicates a grade of better than 60 percent Fe in magnetite and hematite carrying less than 7 percent silica and a small percentage of manganese. Lack of transportation facilities has been the chief obstacle to further development of this property, for nearly 200 miles of railroad would have to be built to bring the ore to the Atlantic Coast. Smelting of the ore in Honduras is not believed possible, because no valuable coal deposits are known to exist.

The impression has often been given, in print as well as orally, that Honduras is an unexplored country with boundless mineral riches waiting only for adventurous capital. Some of the best, if not the only real, prospectors to come to Central America were the Spaniards, who combed Honduras from end to end centuries ago. Few are the mineral deposits examined during the last fifty years which do not show signs of the Spaniards' labor. Interest then was largely in gold, silver, and mercury, but it is an undisputed fact that the use of slave labor made possible the exploitation of veins that cannot be profitably worked today. Minerals considered of little value then may have been overlooked, and it is not impossible that new deposits may be found in the future, but only by those prepared to gamble heavily on indications more speculative than those to be found elsewhere. Anyone interested in undertaking such a program may be assured, however, that the government of Honduras will be most helpful in all possible development of the country's natural resources.

COSTA RICA

War is stimulating investigation of mineral resources and may enlarge the base of the gold mining industry

P. Malozemoff
Manager, Minas de Abangarez, S. A.
La Sierra

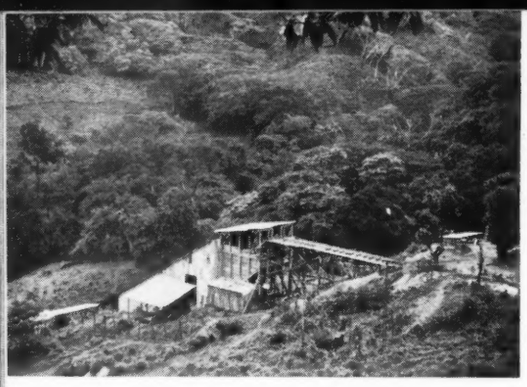
THE MINING INDUSTRY in Costa Rica is now almost exclusively confined to gold, although during the last war considerable manganese was mined in Guanacaste Province, on the Pacific Coast. Gold production in 1941 amounted to little more than $550,000, yet of the total value of exports to the United States during that year, mining accounted for 12.5 percent. Consequently, in the economic life of this little country, hinged as it is on foreign trade with the United States, the mineral industry plays an important part. The livelihood of several thousands of its people depends directly or indirectly upon it, and the gold mined and exported aids in relieving the stringency of foreign exchange. It is no wonder, therefore, that the Costa Rican government is alarmed over the prospect of restricted exports from the United States and of greatly reduced shipping facilities.

Present gold production comes from several districts, all on the western slope of the mountains facing the Gulf of Nicoya. The largest of these is the Abangarez mine, which for about 15 years prior to 1928 produced better than 150 tons per day. Since 1932 it has been profitably worked on a small scale on the leaser-contract system. A flotation and a cyanidation mill are now in operation, the latter treating high-grade ore and the flotation concentrates, and combined capacity of the two mills is about 50 tons per day.

The other productive districts are likewise old in the history of gold mining in Costa Rica, but present operations are all on a small scale. The old Aguacate district has two active mines: the Compania mine, with a modern 40-ton flotation plant, and the Mina Union de Aguacate, operated by Juchem and Sanford, using a small amalgamation-table concentration plant. The Rudin company, until recently operating the Santa Elena mine on the lower Barranca River, has now installed a small flotation plant at the Bonanza mine near the old La Union mine, a fairly large producer before the last war. These four operations represent the larger organized gold producers in Costa Rica, but there are smaller companies with milling units of 5 to 15 tons per day now working in the vicinity of the old Montezuma mine, and in the San Ramon district on the upper Barranca River, which is a comparatively new development.

Activity in the placer gold district near the Madrigal and the Tigre rivers on the Osa peninsula facing Golfo Dulce continues to be confined to manual work by individuals, except for one small dragline working in conjunction with stationary sluices. Some years ago these placers are said to have been examined with favorable results by a North American company which later wanted to install a dredge; however, the Costa Rican government is alleged to have refused a concession on the ground that 400 to 600 men now washing gold there would lose their livelihood. Besides these individuals, a fair number of "high-graders" eke a meager living out of independent workings in lode mine districts, both in productive centers and in those abandoned by organized groups.

Because of the increased price of gold and recent advances in the technology of mining and milling, important quantities of ore either too low grade to extract previously, or over-



Alajuelita mill, new 40-ton flotation unit of Minas de Abangarez, Costa Rica

looked through evident lack of thorough and extensive exploration, may now be developed. This fact is corroborated by each of the present larger producers, who are now mining, in part or wholly, ore left by the old operations. Moreover, there is good possibility of opening up new gold-producing districts, as is evidenced by the recent development in the San Ramon region, and by the wide distribution of known mineralized zones similar geologically to the old producing mines.

Most important of the dormant mineral resources of Costa Rica are the manganese deposits on the Pacific slope in the western part of Guanacaste Province. These have been recently described in some detail by B. N. Webber[1], and consist of numerous small, shallow deposits, the largest of which yielded only about 9,000 tons of ore during its life. Production, stimulated by the last war, reached a maximum of about 10,000 long tons of shipping ore in 1919, but stopped after 1921, and, except for a small promotion attempt a few years ago, the manganese deposits remain inactive. Recent examinations may lead to resumption of manganese mining during the present war, but to date no prospect appears of sufficient importance to indicate much chance of survival in the competition of post-war markets.

Deposits of sulphur are known at Poas near Alajuela, but little investigation has been made to determine whether or not their exploitation would be profitable.

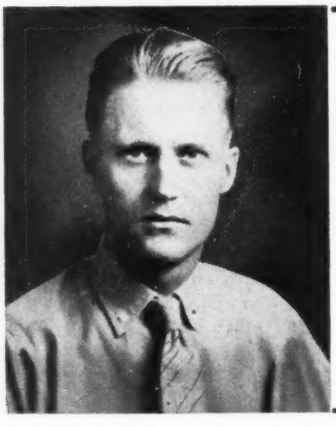
Interest at various times has been aroused in the iron-bearing beach sands on the Gulf of Nicoya, some of which were said to be titanium-free. This statement led a well-known German firm to bid for this raw product before the outbreak of the present war, but nothing has ever actually been done with these deposits. There are also certain showings of iron ore in place in the Guanacaste Province near Guacimal, but they are said to be poor in grade and limited in size. Small coal deposits, also poor in grade, exist at Cerro Tablazo, south of San Jose, and on the San Jose Creek, in the Cahuita district. It is also alleged that deposits of bauxite are known, but they have not been investigated.

Showings of lead and copper ores are known, but nothing on commercial scale has been attempted with these metals. A lead-silver vein near Guacimal has been worked sporadically, and exposures of lead ore have been noted on the easterly continuation of what may be termed the Aguacate lode. At Concovas, south of Cartago; at San Ignacio de Acosta, at Puriscal; and on the slopes of the Irazu volcano have been found float of chalcopyrite, bornite, and chalcocite ores, with narrow non-commercial stringers sometimes in evidence in the vicinity. A rather interesting showing, also of float, exists on the Pacific side of the Peninsula of Nicoya, where many pieces, some containing several pounds of native copper, have been found. The source of these has never been located, because vegetation, soil, and tropical débris cover the country-side and render prospecting extremely difficult. Some, like Concovas, have been explored with underground workings, but no sustained and thorough effort of exploration is anywhere in evidence.

Sound foreign enterprise is welcomed in Costa Rica by both government and people, and the general political situation is good. Property taxes are practically non-existent, the government being supported by various utilities and monopolies. Mining equipment may be imported duty-free by holders of titled claims, and the only contribution exacted is a 3 percent export tax on gold.

The war will undoubtedly stimulate a more detailed investigation of the occurrence of strategic metals like manganese, copper, and lead, which may eventually result in enlarging the base of the Costa Rican mining industry. Recent building of highways and roads and the extension of TACA's commercial airlines within the country have done much to make many mineral districts more accessible and have helped solve the ever-dominant problem of getting in supplies and equipment. If world conditions and metal prices permit, it is not at all unlikely that the mineral industry of Costa Rica will emerge from its present relative quiescence, and will enjoy, once more, stability and a most promising future.

[1] B. N. Webber: "Manganese Deposits of Costa Rica, Central America." Mining Technology, A.I.M.E., March 1942.



NICARAGUA

Gold is historically the basis of the mining industry and is likely to hold that position

Fern Kettel

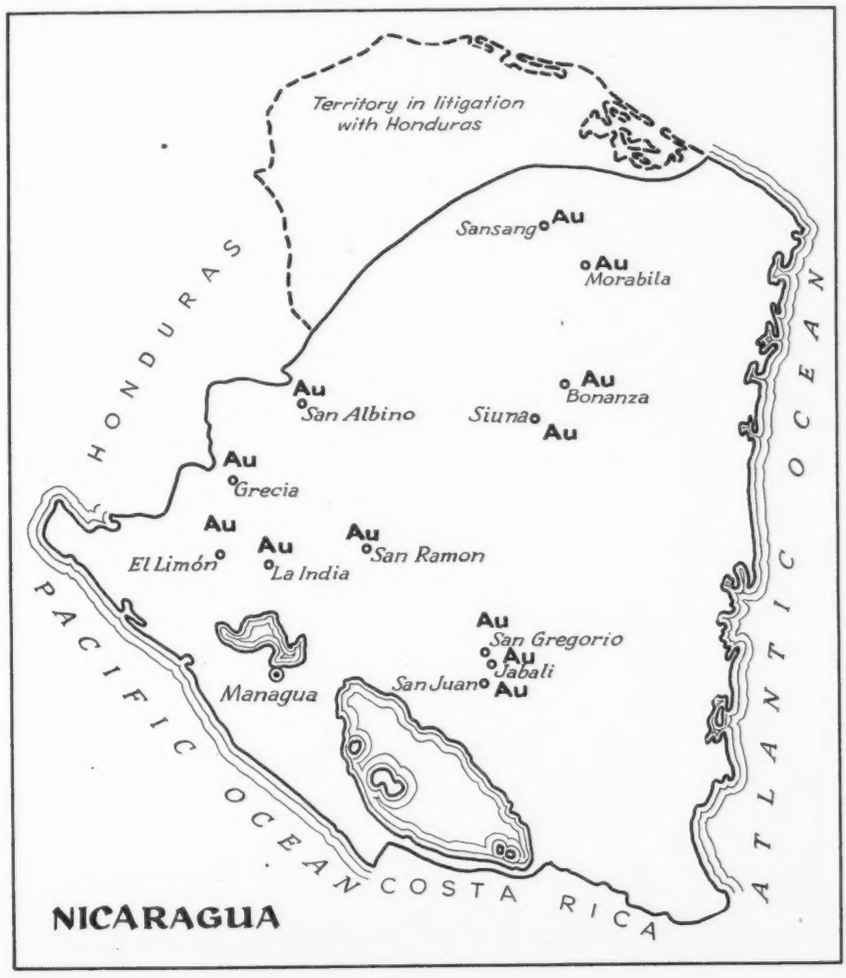
Assistant General Manager, Cia. Minerva La India, Managua

THROUGHOUT ITS HISTORY Nicaragua's mining industry has been exclusively devoted to the mining of gold. Some copper is known to exist in the country, as are also veins of silver and traces of stibnite. So far as I have been able to ascertain, however, no extensive explorations have ever been made for metals other than gold. This is due principally to the fact that prospecting has been undertaken with an eye toward transportation, and because gold obviously possesses the attribute of high value in small bulk it has been more desirable. A certain amount of prospecting in recent months has not revealed commercial deposits of metals essential to the war effort. However, Nicaragua's gold-mining industry, which in recent years has surpassed coffee growing in value, assumes importance at this time because the country's economy has become dependent upon it.

Labor used in Nicaragua mines may be classified as cheap and consequently

inefficient. Wages vary between districts, depending on transportation and accessibility to the mining properties. It may be said that wages are generally higher in the eastern section of the country and that the mining industry as a whole maintains a higher wage scale than any other industry.

Transportation is one of the major problems in Nicaragua. The mines in the Atlantic Coast area depend almost entirely upon air freight. However, they have the advantage of service by a short connecting airline with Puerto Cabezas, which makes them accessible at all seasons of the year. The mines on the western coast are served by a combination of railroad and highway facilities which makes them subject to seasonal transportation, as the roads become almost impassable during the rainy season. The mines in the Chontales district are serviced by a combination of rail, water, and road facilities. Air freight on the west coast and in the Chontales district is prohibitive because the distances demand higher rates.



The accompanying sketch map shows the location of the mines in operation at present. They are briefly described below in the order of their production.

La Luz de Los Angeles, in the Atlantic Coast area, is the largest producer at present, milling 37,500 tons per month. Gold is recovered by cyanidation and flotation. The concentrates of the latter operation are finally cyanided. La Luz mining operations are now confined to open-pit methods, although an underground stoping system will be used in the future.

Neptune Gold Mining Co. (Bonanza), the property of which is north of La Luz, near the east coast, is treating 24,000 tons monthly, using cyanidation. A shrinkage stoping system is used in the mining operation.

Compania Minera La India and Empresa Minera de Nicaragua (El Limon), in the Department of Lean, treat 9,500 tons monthly and 8,000 tons monthly, respectively. La India uses a cut-and-fill system of underground stoping; El Limon uses a combination of open-pit and underground methods.

Compania Minera del Javali, in Chontales, Nicaragua's oldest mining district, has been operating continuously for more than 80 years. Javali treats 5,550 tons of ore per month, which is obtained by underground methods.

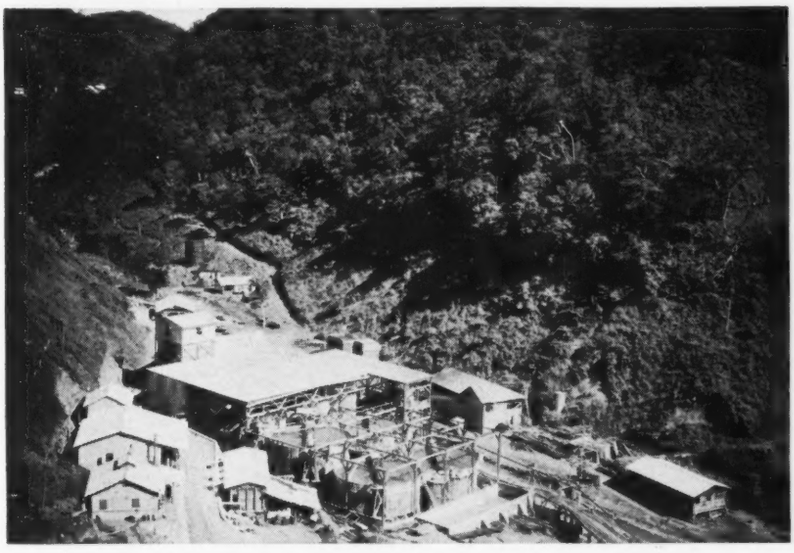
San Juan Mines, Inc., in Chontales, treats 4,000 tons per month by sand leaching in cyanide solution. The ore is obtained by a combination of surface stripping and underground methods.

Compania Minas Matagalpa (La Reina), in the department of Matagalpa, and Compania Minera de San Gregorio, in Chontales, treat 3,000 tons per month and 1,000 tons per month, respectively.

At all of the above-mentioned properties gold is recovered from siliceous (quartz) ore by using cyanidation as the basic metallurgical process.

A copper prospect of commercial grade, provided transportation facilities can be made available, is known to exist in the east coast area. Silver was at one time produced in the northwest section of the country and would undoubtedly be developed again if the price should warrant it. Based upon what is known at present, however, regarding the mineral resources of Nicaragua, it can be safely predicted that the mining industry in this country will be based predominantly on gold production.

Mill and power plant of Cia. Minera La India, 300-ton gold and silver mine in Nicaragua



MINE, SHOP, AND PLANT

Again the S.O.S.

MAINTENANCE IS ESSENTIAL to production, but the less of it a company has to do the better. "Our job is digging ore—not spending time on maintenance," said one superintendent some time ago, arguing for ruggedness and simplicity in design of mine equipment. "The more rugged it is and simple, the more practical it is for mining work. Remember, a lot of this equipment is operated, of necessity, by inexpert and partly trained men. We want it durable and foolproof."

This lack of training comes about through the loss of mechanical men and repairmen to the armed services and war plants. "As a result," the super says, "we've got to train a lot of fellows for mining work especially for maintenance. Anything the equipment manufacturers can do to help will be appreciated—either in their advertising or otherwise. Also, if they've got substitute materials, let us know about them and how to handle them when we get them."

Metallizing for Salvage

SECOND ONLY to the supply house as a defense against shutdown, the scrap pile has saved the day more than once for the average master mechanic, when saddled with an emergency and in need of a part. One might think that the scrap had all disappeared, to hear current talk, and yet we wager that a survey will show the same old landscape-defacing dumps alongside many a shop or concentrator that we have known in the past. Perhaps some parts, such as shafting, nowadays never get to the scrap heap, thanks to ability to build them up with welding or the more modern metallizing. The latter procedure, using a metal spray gun, has been described in these pages[1], but is still unfamiliar to many. Respecting it, one operator testifies thus:

"We are saving a lot of expensive steel shafts by building them up with this gun. It attaches to the tool post of a lathe. We then connect compressed air and acetylene lines and insert the metal wire which supplies the sprayed metal. The metal melts at the point of the nozzle and is sprayed on the shaft at the worn journals.

"We bought this last fall on account of the war and have salvaged 24 shafts with it since then. It can be used for spraying any metal that can be drawn into wire $\frac{1}{8}$ in. or 1/16 in. in diameter.

"Stainless steel in mine pumps can be built up with this gun. The stainless-steel wire produces a spray which, when set, will resist acid water.

"There is a big saving on locomotive axles thus treated. When repaired with other methods they likely break on account of internal stresses set up. The spray gun, however, makes a durable repair, building the axle up slightly oversize and enabling us to dress it down to exact finished dimensions of the original shaft at the journals."

[1] Metallizing Drum Shaft of Hoist," *E. & M. J.*, March, 1942, p. 44. Also "Metallizing in the Homestake Shops," *E. & M. J.*, Jan., 1939 p. 36.

Interchangeability

AT TIMES LIKE THESE, when mining equipment is hard to get, talk of simplification and standardization may seem inopportune. Yet on these factors depends that of interchangeability of parts, which in turn has its effect on maintenance. Maintenance is simplified to the extent that parts are interchangeable; likewise purchasing and the job in the supply house.

Where a company's operations have extended over many years, types and sizes of, say, the drills or pumps in service are likely to have multiplied. A good example is afforded by a large company which has over 200 pumps installed in and around its mines, comprising all the principal types, 27 different makes, and a still larger number of sizes.

No one, of course, will argue for scrapping equipment that is still able to render service, unless the records show the repair cost to be unduly high, something that is likely to be ignored just now when every item counts. Where new equipment is needed, however, and can be had, it will do no harm to consider the question of interchangeability.

Belt Rescue

A SALVAGE PROGRAM for rubber belts is practical for two reasons, according to B. F. Goodrich. First, worn plies can be removed and belts cut to proper size for smaller drives. Second, salvaged belts can be vulcanized and made endless in the field, thus making the smaller belt almost as good as new.

Each operator will have to work out his program to suit his own conditions. The following example is given to show the possibilities:

A typical service life of an 18-in. 8-ply belt: When worn through the pulley ply, it will be cut down to a 14-in. 6-ply belt or divided into 8-in. and 6-in. 6-ply belts; and later, these belts will be cut down to 4-ply belts in 3-in., 4-in. or 6-in. sizes.

Vulcanizing short lengths is also practical. Thus remnants of new belt can be spliced together for service.

To pull plies from a used belt, simply use carpenter's pincers and pull off in strips 3 or 4 in. wide, by hand. Start the width to be stripped and let one edge rip. A special knife which cuts through only one ply is available. If the pulley-side ply is badly worn it cannot be pulled off separately. Pull it off with the next ply. Do not pull with chain fall or rope tackle, as this will make the job too difficult.

Serious injury to a *new* belt need not put it out of service. A short length can be spliced and vulcanized to give a belt as good as new.

Wide belts which break in service are cut into narrower widths and used on light service drives.

Longer service can be expected of re-cut belts if the edges are painted with a penetrating coating made especially for this purpose.

Raw-edge belts are more adaptable to salvage, although an effective job of salvaging folded-edge belts can be done with careful planning.

How to vulcanize will be described next month.

Long Life for the Air Hose

WHETHER for rock drill or pneumatic tool, the air hose merits careful handling. Though use of oil-resistant compounds has increased its life in recent years, attention to some points will further lengthen its period of service. One manufacturer advises:

Protect the hose from overheated oil by keeping the compressors in good repair, particularly the aftercoolers. Keep the cover clean, wiping off oil with clean waste as soon as possible and washing off mud or concrete.

Use high-pressure couplings with clamps which fasten to the shank. The quickly detachable type is satisfactory on light tools and portable compressors. Do not use pipe nipples or ordinary shank couplings held in place with standard bands or clamps.

Turn hose end for end from time to time to alternate the positions of greatest exposure to oil and greatest flexing. Avoid kinks—if they do occur, untwist them carefully. If hose is to be stored, wash it out with clean water and drain.

When the air tool is idle for a time, though with the job unfinished, turn off the air at the compressor to stop the flow and open the tool nozzle or outlet valve to release the pressure on

the hose carcase. Experience and observation have shown that trapped air under pressure weakens the fabric or the braid.

The Hook-Up

HOSE COUPLINGS and fittings should be properly attached for longer life and greater safety. Many accidents occur, especially with compressed air or steam, because of improper attachments. The following should be remembered:

See that burrs or sharp points are removed from the stem of couplings or the nipple. The end of the stem should be rounded off so as not to cut the tube.

Coat the inside of the hose with soap solution or rubber cement and also apply this to the shank. Insert the shank quickly, before the cement dries, for best results.

Take care to buy a coupling with a stem of correct size. However, if the stem is too large to enter the hose, do not cut away any portion of the tube, but turn the stems down on a lathe.

When attaching couplings of the seat or socket type, cut the hose end as square as possible to allow it to seat properly. This will prevent fluid from leaking between the hose tube and cover and wicking its way through the hose, causing premature failure.

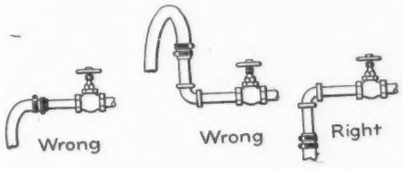
If the hose does not have capped ends (rubber covering over ends of fabric), apply several coats of rubber cement to exposed fabric. This will eliminate wicking or retard its progress.

Do not drive a coupling into hose with a hammer or mallet but force it in evenly and squarely after lubricant has been applied. Place the coupling in a vise and push the hose over the coupling sleeve.

Use clamps of correct size and draw them up tight. It is preferable to have a small space left between the lips of the clamp to allow for future taking up. For best results, a special hose clamp vise should be used, on which the clamp is forced together by special jaws which grip the lugs.

To couple wire-wound hose, turn the end of the wire at right angles so that it follows the hose and can be clamped down securely.

Important! After the hose is coupled, it should be mounted to hang in a vertical, or natural position, to avoid unnecessary strain.



The right way and the wrong way of attaching the hose to the line

Sanding brushes to a good fit with the commutator is essential whenever new brushes are installed on a d.c. motor

Care of Insulation In Motor Maintenance

IN THE MODERN PLANT the motor is, as it were, the heart of things, even though there are other vital parts. So we have given ample space to O. C. Vea's discussion of the care and maintenance of electric motors, which is concluded in the following paragraph.[1] Incidentally, Mr. Vea is a G.E. engineer. His advice on insulation is as follows:

Care of insulation goes hand in hand with lubrication as one of the major features of a motor-maintenance program. These features concern the most vital, and probably the most vulnerable, parts of a motor.

Motors should always be stored in a dry, clean place until installed. Heat should be supplied to protect against alternate freezing and thawing. Those that have been long in transit in a moist atmosphere, or idle for an extended period, should be thoroughly dried out before being put in service. Since machines sometimes "sweat" as a result of a difference in their temperature and that of the surrounding air, they should be kept warm at all times to prevent this.

The most effective method for drying out motors that have become wet by accident or because of "sweating" is to pass current through the windings, using a voltage low enough to be safe for the winding in its moist condition. Thermometers should be placed on the windings to see that they are heated uniformly. Temperatures should not exceed 90 deg. C. (Class A insulation). This method is particularly effective on high-voltage motors, where the insulation is comparatively thick.

Heat can be supplied externally in extended idle periods by placing heating units around the machine, covering with canvas, and leaving a vent at the top to let moisture out. In doing this, there must be a circulation of warm air over all the surfaces to be dried. The air should be let escape as soon as it has absorbed moisture.

Twelve-inch fans set to blow air across the fronts of "glow heaters" and then into the lower part of a motor from opposite sides will give good results. Winding temperature should not exceed 100 deg. C. for Class A insulated motors. Smaller machines can be placed in ovens, the same temperature limits being observed.

Time required for complete drying-out depends considerably on motor size and voltage. Insulation resistance measurements should be taken four or five hours apart until the value is fairly constant. These tests indicate the general condition of the insulation.

The resistance should at least equal the recommended AIEE standard, which is:

$$\text{Megohms} = \frac{\text{Rated voltage of the machine}}{\frac{\text{Rating in kva.} + 1000}{100}}$$

Insulation-resistance tests should also be made before a high-potential test, to determine whether the insulation is ready for such a test and has not been injured.

High-potential tests should be made after drying out or after repairs to check the dielectric strength of the insulation. New windings should successfully stand a test at twice the normal voltage plus 1,000. Motors in operation for some time should be tested thus, *after thorough cleaning and drying*, using a voltage of about 150 percent of normal, applied for one minute.

Small high-potential testing sets are

[1] The subject of motor maintenance is discussed in Mine, Shop and Plant in the June and July issue respectively of *E.&M.J.*

available and are of such capacity that little damage will result from a breakdown during the test.

Dusts are highly abrasive and actually cut the insulation while being carried through by the ventilating air. Hence the desirability of periodic cleaning. If conditions are severe, open motors might require a certain amount of cleaning each day; otherwise weekly inspection and partial cleaning.

For weekly cleaning, the motor should be blown out with dry, compressed air (25 to 30 lb. per sq.in.). Where conducting and abrasive dusts are present, an even lower pressure may be necessary, and suction is preferred, as damage can be caused by blowing dust and metal chips into the insulation.

In cleaning, the heavy dirt and grease should first be removed with a heavy, stiff brush, wooden or fiber scrapers, and cloths. Rifle-cleaning brushes can be used in the air ducts. Dry dust and dirt may be blown off, using dry compressed air at moderate pressure.

Grease, oil, and sticky dirt are easily removed with a cleaning liquid like carbon tetrachloride, gasoline, or naphtha. There are several good ways of doing this. Probably the best is to spray it on. Care must be taken not to soak the insulation by dipping coils or small motors in it.

While the insulation will dry quickly at ordinary room temperature, it is desirable to drive off all moisture before applying varnish. If the motor can be spared long enough, the insulation should be dried out by heating to from 90 to 100 deg. C.

While the motor is warm, a high-grade insulating varnish should be applied. For severe acid, alkali, or moisture conditions where oil or dusts are present, special varnishes can be had. The varnish may be sprayed or brushed on. For small stators or rotors, it is best to dip the windings into it, cleaning the adjacent metal parts afterwards with a solvent of the varnish. After varnishing, best results are had by baking as recommended by the varnish manufacturer, from 3 to 7 hours at about 100 deg. C.

Motors should be overhauled every five years or so, normally, or, if in severe service, more frequently. This will aid in avoiding breakdowns and in extending the useful life. The following suggestions may be helpful:

Check the motor air gap, between stator and rotor, with feelers for uniformity. Small clearance at the bottom may indicate worn bearings.

Take the motor apart and inspect thoroughly. Measurement of bearings and journals may indicate need for new linings. Remove waste from waste-packed bearings and rearrange or replace it, so that any glaze on the wool is removed from its point of contact with the shaft. A gummy deposit means that the wool should be replaced. All lubricant should be cleaned out of the bearings and a fresh supply put in when the motor is reassembled.

The rotors should be cleaned with a solvent to remove accumulated dirt, after which rust should be removed with fine sandpaper (not emery paper). When clean and dry, the rotors should be coated with a good clear varnish or lacquer to protect from moisture. To prevent injury to the bearings, they should be completely protected with a clean rag when the motor is disassembled. Rotors of wound-rotor motors should be given the same treatment as the stators. In addition, soldered joints and binding cords should be inspected. The stator bore should be cleaned with a solvent, and rust removed with fine sandpaper (not emery paper). Care should be taken not to damage the top sticks or end turns of the stator winding. When the bore has dried, any dirt remaining should be wiped out with a cloth or brushed out with a soft brush. A hand bellows or dry compressed air at low pressure may also be used under the same precautions mentioned for the rotor.

The megger is a convenient means of determining the condition of insulation by indicating its resistance to leakage currents

Points on the D.C. Motor

TO INSURE efficient operation of d.c. motors, the following should be done systematically:

For satisfactory operation of brushes, they must move freely in their holders. Check this. Uniform brush pressure is necessary to assure equal current distribution. Holders should be adjusted so that the face is approximately $\frac{1}{8}$ in. up from the commutator; distance greater than this will cause brushes to wedge, resulting in chattering and excessive sparking.

Check the brushes to make sure that they will not wear down too far before the next inspection. Keep an extra set on hand. Sand in new brushes, and run the motor without load as long as possible.

Make sure that each brush surface in contact with the commutator has the polished finish that indicates good contact, and that the polish covers all of this surface.

When replacing a brush, put it in the same holder and in its original position. It is helpful to scratch a mark on one side of it when removing it so that it will be replaced properly.

When installing new brushes, fit them carefully to the commutator. To do this, insert a strip of fine sandpaper, sand side up, between commutator and brush. Rotate the commutator back and forth, allowing the brushes to bear on the sandpaper only when the commutator is moving in the proper direction of rotation.

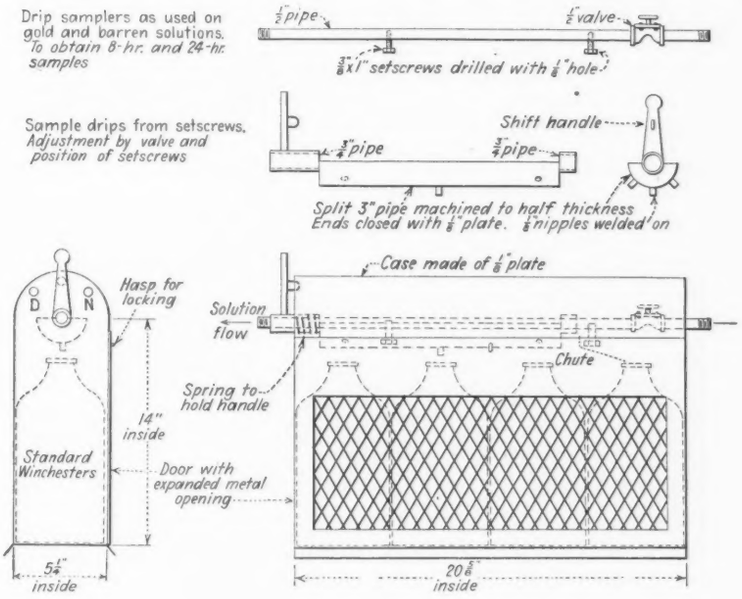
The brush should be lifted so it will not touch the sandpaper, on the back pull. Sand only until the curve of the brushes is the same as that of the commutator. Be sure that brush shunts (pigtails) are fastened securely so that current will not overheat the brushes and brush holders.

Check the springs that hold the brushes against the commutator. Improper pressure may lead to commutator wear and excessive sparking. If excessive heating has annealed the springs, they should be replaced and the cause of heating corrected. Larger motors have means for adjusting the spring pressure, which should be 2 to $2\frac{1}{2}$ lb. per sq.in. of area of brush contact with the commutator.

Inspect the commutator for color and condition. It should be clean, smooth, and a polished-brown color where the brushes ride on it. A bluish color indicates overheating.

Roughness of the commutator should be removed by sandpapering or stoning. Never use emery cloth or an emery stone. For this operation, run the motor without load. If sandpaper is used, wrap it partly around a wood block. The stone is essentially a piece of grindstone, known as a commutator stone. Press it, or sandpaper against the commutator with moderate pressure with the motor running without load, and move it back and forth.

USEFUL OPERATING IDEAS


Drip samplers as used on gold and barren solutions. To obtain 8-hr. and 24-hr. samples
Sample drips from setscrews. Adjustment by valve and position of setscrews
Shift handle
Split 3" pipe machined to half thickness
Ends closed with plate. nipples welded on
Case made of plate
Hasp for locking
Solution flow
Chute
Spring to hold handle
14" inside
Standard Winchesters
Door with expanded metal opening
inside
inside

Cyanide Solution Samplers

VARIOUS SOLUTION SAMPLERS have been devised by millmen for obtaining small representative samples of process solutions. "The one shown in the drawing has some advantages over others I have seen, in that it is a compact unit, is readily adjustable by an ordinary wrench, and the samples can be locked in if desired," writes R. D. Lord, mill superintendent of Preston East Dome Mines, South Porcupine, Ont.

The sampler is put into operation by connecting the ½-in. pipe to the solution line or tank to be sampled at any convenient point that will give a pressure head of 5 ft. or more. The excess solution passing away from the sampler is discharged to a sump or otherwise delivered back to the circuit.

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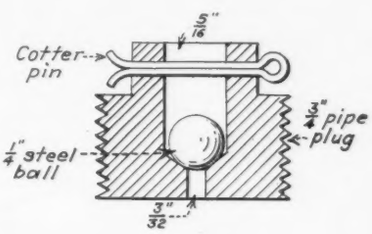
Air Release For Pipe Line

A COMMON CAUSE of trouble with small pipe lines in the desert climate of the Southwest is the amount of air carried over with the water, writes Charles Labbe, Johnnie, Nev. As the lines are laid over rough ground in hills and canyons, entrained air may accumulate at the high points, forming troublesome airlocks. The difference in temperature day and night gives some relief. Where air pockets change in size and may carry over, causing interruptions in the flow of water, a remedy is to place air releases at the high points.

If the pipe line is run on the gravity system, it requires a small hole drilled at *every* high point, so that the water flows of its own accord; with the balanced siphon (which carries more water) the air must be eliminated at the first opportunity—at the first high place and also at the second high place, as air inclosed in the water is released in traveling.

The ready-made air releases used proved unreliable on the balanced siphon. At first they release the air, but once the pipe is filled with water the valve closes and remains closed by pressure; where water is replaced by air under the same pressure, the valve will not open and an air pocket is formed. When the pipe is filled with water and the siphon draws, the air release valve opens from the suction, admits air, and thus "breaks" the siphon, and so on continuously, to the dissatisfaction of the water user.



A different type of air valve was developed which gave best results and is of a simpler construction: A $\frac{5}{16}$-in. hole is drilled in a full-sized ¾-in. pipe plug for three-fourths of its length and a $\frac{1}{16}$-in. or $\frac{3}{32}$-in. hole the rest of the way. A common steel ball of ¼-in. diameter is dropped into the $\frac{5}{16}$-in. diameter hole. The square top is then drilled through to admit a ⅛-in. cotton pin to keep the ball from falling out.

Operation is simple: The accumulated air easily opens the valve and escapes. Some little water, relatively insignificant, may escape, the valve being placed on a nipple above a high point of the pipe line. When the air is out, the siphon operates of its own accord while the valve remains tightly on its seat. An intermittent quantity of air entrapped can release itself by reason of its own elasticity and not stop the siphon.

According to the mineral content of the water, a brass plug may be preferable to an iron one.

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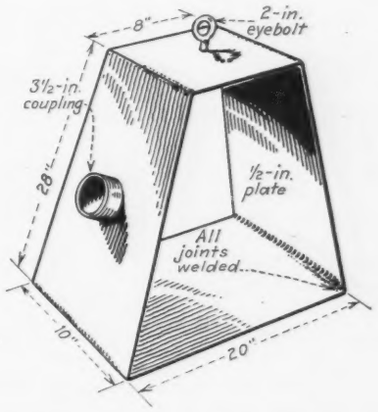
Handling Wheels Of Locomotives

REMOVING LOCOMOTIVE wheels from their axles can be done with added safety by employing a stand specially made to hold



the loose wheels rigidly instead of resting these against a column, machine, or wall where they can be tipped over, with possible injury to workmen, according to P. C. Ziemke, Milwaukee, Wis. "In our shops," he says, "the hydraulic press is supplemented with two sturdy stands fashioned from ½-in. plates cut on the power shears and arc-welded to form an A-shaped stand. The inclined side is provided with a 3½-in. pipe coupling placed

at the proper height to engage the center bore of the wheel as it is leaned inward against the stand. The pipe coupling, like the rest of the unit, is arc-welded, as is also the 2-in. eyebolt provided to make it easy to shift the stand from place to place.

"Use of the stand also spares one the back-breaking labor of shifting wheels up from a flat position on the floor when they have fallen over. The wheel held upright also remains free of dirt and ready for its coating of white lead for the pressing operation."

Five Dollars for an "Idea"

SHORTAGE OF EQUIPMENT in the present emergency puts a premium on the ingenuity of master mechanics and electricians to keep mining and milling machinery running. If you have done an interesting job, just sketch or photograph it and send it in with a brief description. *E.&M.J.* will pay $5 for acceptable items.

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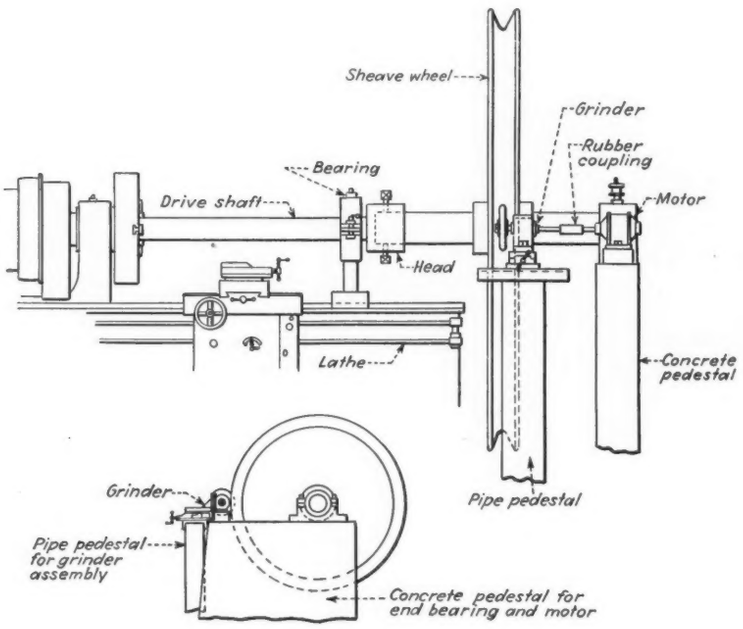
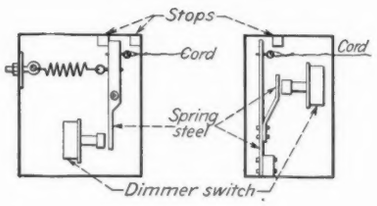


Rectifying Hoisting Sheaves

A JOB PERFORMED periodically at the average mine machine shop is the reconditioning of the cable groove and tread of large sheave wheels. This is a simple matter when appropriate machine units are available, but difficult if a sufficiently large lathe to accommodate the sheave is lacking. The mechanical department of Mountain City Copper Co., Rio Tinto, Nev., faced with the necessity of grinding the large sheaves on the headframe over the main shaft, and having no special lathe for this purpose, solved the problem successfully with the ingenious set-up shown.

Compared with the conventional center method, the shaft of the sheave rests in two bearings, one such as used on the headframe proper, and the other just behind the head at the end of the drive shaft holding one end of the sheave wheel shaft. The grinder assembly is installed on a pipe pedestal, and power is transmitted from a small motor on the concrete end pedestal holding the outer end of the sheave wheel shaft through a rubber coupling. The motor can be operated at any speed, as a series of resistances are tied into its control.



Dimmer Switch In Remote Control

FOR REMOTE CONTROL of underground conveyors including self-loading shakers the bell-cord system, such as used in railroad trains, has been adopted at some mines. As an electrical unit for the alternate "On" and "Off" mechanism, the standard and inexpensive dimmer switch for controlling automobile headlights has proved satisfactory and efficient if the control currents are small.

The problem is to obtain a ruggedness whereby an excessive strain on the cord will not damage the spring which effects the cord return and will not put undue force on the pushbutton of the dimmer switch itself. Two of the numerous ways by which this "mine" ruggedness can be accomplished are shown in the drawing at the top of this column.

In the one at the left, which uses a pivoted lever, tension of the spring effecting cord return can be adjusted. In this design the lower end of the lever consists of a leaf spring which limits the pushing force on the dimmer switch. In the arrangement shown at the right a secondary spring riveted to the main spring leaf accomplishes the limiting of force exerted against the dimmer switch. In both designs, with the cord pull attachment eye set close to the stop block, no harm can result from excessive cord pull or jerk —except breaking the cord.

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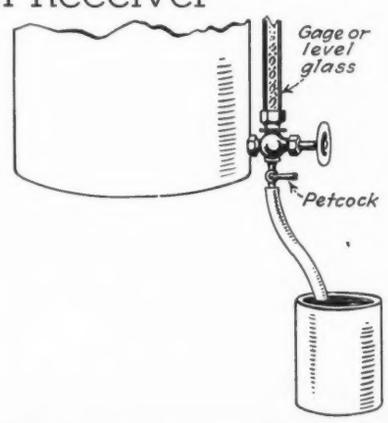
Cleaning Gage Glass On Vacuum Receiver

A SIMPLE METHOD of cleaning gage- or level-glasses on vacuum receivers or Crowe towers has been successfully used by L. E. Bruno, Getchell mine, Redhouse, Nev. A length of small hose is placed over the lower drain petcock of the gage-glass and a glass tube is inserted in the other end and put in a beaker containing a quart of 50 percent hydrochloric acid. When the petcock is opened, the vacuum will draw the acid solution into the receiver through the gage-glass, leaving it clean and easy to read.



PERSONAL ITEMS

Dr. Oliver Bowles, geologist, mining engineer, and internationally known authority on non-metallic minerals, has been named chief of the Non-metal Economics Division of the U. S. Bureau of Mines. Dr. Bowles, who formerly

DR. OLIVER BOWLES

was assistant chief of the Non-metal Economics Division, has been with the Bureau since 1914. He is the author of more than 100 Bureau of Mines publications. His 500-page book, "The Stone Industries," is one of the most comprehensive volumes written regarding quarrying in the United States and has received widespread circulation. Several years ago, Dr. Bowles introduced to the slate industry a wire saw for cutting slate. This implement is estimated to have saved the industry more than $250,000 annually in production costs by speeding the output of slate and by eliminating waste. After joining the Bureau, Dr. Bowles was a quarry technologist and was assigned to study problems and production methods of the stone industries. From 1923 until 1928 he was supervising engineer of the Non-Metallic Minerals Experiment Station of the Bureau at New Brunswick, N. J. Prior to joining the Bureau, Dr. Bowles had gained extensive experience in the field of geology. During the summers of 1908 to 1910, Dr. Bowles carried on geologic field work in the wilds of Northern Ontario. He taught mineralogy and petrography at the University of Michigan and at the University of Minnesota and took graduate work at both universities. As chief of the Non-metal Economics Division of the Bureau, Dr. Bowles fills a vacancy created by the resignation of **Paul M. Tyler,** who left the Bureau to join the Board of Economic Warfare.

Frank Cooper, metallurgist, Los Angeles, Calif., has gone to Escuinapa, Sinaloa, Mexico.

Hugh S. Bostock is directing a geological party in the vicinity of Mayo, in the Yukon Territory.

Oscar H. Chavez is employed as junior engineer with Cia. Minera Kildun y Anexas, Matehuala, S.L.P., Mexico.

H. P. Willard, formerly engineer for Summit King Mines, Fallon, Nev., is now with Basic Magnesium, Inc., Luning, Nev.

C. E. Lawall, president of West Virginia University, has been elected to the Council of the Society for a three-year term.

T. C. Hewitt, recently superintendent of Gold Mines of Kalgoorlie, Ltd., at Kalgoorlie, has joined the Ordnance Department, Commonwealth of Australia.

S. F. Shaw, consulting engineer of San Antonio, Tex., is examining fluorspar and tungsten properties in Colorado and mica properties in New Mexico.

Victor Bongard, formerly general manager of Cardinal Gold Mining Co., Bishop, Calif., has joined the staff of Fresnillo Co., Fresnillo, Zacatecas, Mexico.

John G. Barry has been appointed head of a permanent field staff of the Metals and Minerals Division of BEW, with offices in Mexico City.

Charles F. Jackson, chief of the Mining Division of the U. S. Bureau of Mines, has tendered his resignation and has gone fishing.

J. V. Claypool has been appointed manager of industrial relations for the Oliver Iron Mining Co., Duluth, Minn. He succeeds the late John B. Patrick.

Blair Burwell, manager of Western operations for the U. S. Vanadium Corp., lately investigated tungsten claims near Tonopah, Nev.

O. H. Metzger, resident engineer for the U. S. Bureau of Mines at the Reno station, has been moved to Portland, Ore.

W. J. Loring has been retained by the Portola Corp. to direct the reopening of the once-prolific Plumas-Eureka mine, at Blairsden, Calif.

Jack Cornelius, formerly metallurgist to Gold Mines of Kalgoorlie Ltd., at Kalgoorlie, Western Australia, is now engaged in the manufacture of munitions.

Dr. E. S. Hills, associate professor in the department of geology at the University of Melbourne, has been awarded the Wollaston Fund by the Geological Society of London.

Paul M. Price, until recently engineer at the Bonanza Mines, Jensen, Utah, is now in the employ of Vanadium Corp. of America at its tungsten mines in Boulder County, Colorado.

F. McIntosh Galbraith has resigned as geologist for Falconbridge Nickel Mines, Ltd., Falconbridge, Ontario, and has gone to Wallace, Idaho, where he is associated with the Day interests.

F. F. Espie, general manager of the Burma Corp., Ltd., Namtu, Burma, has reached Calcutta from the company's mines, which were evacuated on account of enemy advance.

John D. Vincent, recently metallurgist, U. S. Bureau of Mines, Salt Lake City, Utah, is metallurgist for the Dow Chemical Co.'s Great Western Division at Pittsburg, Calif.

Kenneth A. Phillips, formerly assistant professor of mining engineering at Iowa State University, Ames, Iowa, is now with the American Zinc Co. of Tennessee at Mascot, Tenn.

William W. Lynch has resigned as assistant California manager of the American Potash & Chemical Corp., Trona, Calif., and may be addressed at Wilson Point, South Norwalk, Conn.

Theodore A. Dodge has left Las Cruces, N. M., and has joined the geological department of the Cananea Consolidated Copper Co. in Cananea, Sonora, Mexico.

Herbert C. Enos, consulting mining engineer, has returned to Chatsworth, Calif., after completing an assignment for the Minerals Division of the Board of Economic Warfare in Brazil.

William Newman has been named chief of the ad valorem tax department of the Oliver Iron Mining Co., Duluth, Minn. He was formerly a member of the St. Louis County Board of Commissioners.

Alberto Terrones Langone, geologist, Mexico City, has been awarded an Inter-American Trade Scholarship in economic

ALBERTO TERRONES LANGONE

geology by the Coordinator of Inter-American Affairs and will report immediately at the Coordinator's office in Washington, D. C., for further instructions.

Paul Clarke, manager of the Morning Star (G.M.A.) Mines, N.L., at Wood's Point, Victoria, has resigned that position and joined the Department of Supply and Development, the function of which is to increase the production of base metals in the Commonwealth.

S. T. Hilberg is chief engineer for the Gray Eagle Copper Co., Happy Camp, Calif. Mr. Hilberg was formerly em-

ployed as mine superintendent by the Alhambra-Shumway Mines, near Kelsey, Calif.

William Bradley, recently with the Vanadium Corporation of America at Carnegie, Pa., has accepted a position as engineer for the fluorspar division of the U. S. Coal & Coke Co., Mexico, Ky.

A. W. Pryor, of Ely, Minn., was recently made superintendent of the Douglas Mine at Chisholm, Minn., by the Evergreen Mines Co. He was formerly assistant superintendent at the Chandler mine, in Ely.

Clyde E. Weed, vice president in charge of mines for the Anaconda Copper Mining Co., has been elected president of the National Tunnel & Mines Co. Mr. Weed succeeds **Frederick E. Laist,** vice president in charge of metallurgy, who recently resigned.

Roy K. Brown, mining engineer, has been appointed manager of the Eagle Shawmut mine, at Chinese Camp, Calif., succeeding **D. C. Peacock,** who is now in charge of the mine and mill of Southwestern Graphite Co. at Burnet, Tex.

W. D. McMillan, under the recent reorganization of the U. S. Bureau of Mines, has been transferred to the Central Region and appointed district engineer for the States of Missouri, Oklahoma, and Kansas, with headquarters in Rolla, Mo.

Robert S. Moehlman, of the Anaconda geological staff, formerly stationed at Butte, has established an office in Reno and is supervising prospect drilling on Nevada copper properties held under option by Anaconda's subsidiary, International Smelting & Refining Co.

Austin B. Clayton, formerly mine-section superintendent with Bolivian Tin & Tungsten Mines Corp. at Huanuni, Bolivia, is now employed as shift boss by Anaconda Copper Mining Co. at Benbow mine, Dean, Mont.

Livingstone Porter, Jr., has resigned his position as mine engineer and geologist for the U. S. Gypsum Co., Midland, Calif., and has accepted an appointment as junior geologist in the Water Supply Branch of the U. S. Geological Survey at Santa Barbara, Calif.

Alex F. Ross, general manager for the Argonaut Mining Co., Ltd., operating at Jackson, Calif., was one of a number of Western mining men to address a meeting at Reno late in July with members of a subcommittee of the Senate silver committee.

R. C. Wilmot, who is engaged in mercury production in Oregon with his father, **H. C. Wilmot,** well-known engineer and formerly of British Columbia, recently made an examination of cinnabar occurrences in the interior of British Columbia.

Mrs. Viola R. MacMillan has been appointed a member of the Canadian War Metals Advisory Committee. She is secretary of the Ontario Prospectors and Developers Association. Also named as members of the committee are **A. A. MacKay, Willett G. McBride, E. V. Neelands, Balmer Neilly,** and **J. G. McCrea.**

Richard Vail is in Washington. After making some field trips for one of the Materials Divisions of WPB, he has been detailed to the Board of Economic Warfare, where he will be engaged in the Non-Metallic Minerals Section of the Metals and Minerals Division, of which **Paul M. Tyler** is chief.

J. G. Woodcock, mine manager; and L. Gaudaur, mill superintendent, at West Malartic Mines, Ltd., 10 miles from the town of Malartic and 3 miles south of the main highway, in Malartic Township, Quebec.

John J. Forbes, former chief of the Coal Mine Inspection Division of the U. S. Bureau of Mines, has been named chief of the newly created Mineral Production Security Division. **Simon H. Ash,** former district engineer of the eastern Pennsylvania region and adjoining states, has been named chief of the Metal and Non-Metallic Mineral Mining Section of the new division.

O. P. Dolph, formerly in charge of milling operations for the Amparo Mining Co., Etzatlan, Jalisco, Mexico, and later shift boss in the flotation-cyanidation plant of the Saudi-Arabian Mining Syndicate at Mahad Dahab, Saudi Arabia, has returned to Mexico and is employed at the Torreon smelter of the Peñoles Mining Co.

J. R. Van Pelt, Jr., technical director of the Museum of Science and Industry, Chicago, was elected chairman of the Mineral Technology Division of the Society for the Promotion of Engineering Education at its annual meeting held at Columbia University. **Joseph F. Oesterle,** chairman of the department of Mining and Metallurgy, University of Wisconsin, was elected vice chairman.

Henry Mulryan has been admitted to the firm of Wright, Dolbear & Co., consulting mining engineers and geologists, with headquarters at 417 South Hill St., Los Angeles. The New York office of the firm has been removed from 17 Battery Place to 11 Broadway. The San Francisco office remains at 206 Sansome St. Other associates in the firm are **H. Foster Bain** and **Walter Lyman Brown.**

Robert D. Macdonald has been named a research engineer on the technical staff of Battelle Memorial Institute, Columbus, Ohio, where he has been assigned to the materials beneficiation division. Mr. Macdonald is a graduate of the Montana School of Mines and the Massachusetts Institute of Technology.

Harry E. Krumlauf, mining engineering; **Dr. R. F. Makens,** chemistry; **E. W. Wiedenhoefer,** civil engineering; and **Russell J. Smith,** metallurgical engineering, of the faculty of the Michigan College of Mining and Technology, have been promoted. The first three mentioned have been made associate professors. Mr. Smith has been advanced from instructor to assistant professor.

Ellis H. Davies, who for many years has been chief engineer of Charles Ruwolt, Pty., Ltd., one of the largest manufacturers of mining machinery in Australia, has been transferred to the Allied Works Council as director of mechanical equipment. He has also been appointed advisory engineer for plant and equipment to the Minerals Production Committee and to the Controller-General, **J. Malcolm Newman.**

The Hon. Herbert Anscomb, B. C. Minister of Mines, presented prizes to winners at the annual competition of the Similkameen Valley Mine Safety Association, held recently in Princeton. Judges included **James Dickson,** Chief Inspector of Mines, and **James Strang,** Inspector of Mines. The reception committee consisted of **W. R. Lindsay,** general superintendent of the Granby company, and **W. S. Douglass,** manager of the Kelowna Exploration Co., Ltd.

Dr. Thomas E. French, professor of engineering drawing and chairman of the department at Ohio State University, will retire from active duty with emeritus rank on Sept. 1. Widely known among engineers for his textbook on engineering drawing, Dr. French has served on Ohio State faculty for 47 years since receiving his degree there in 1895. Professor French has gained recognition in several of his hobbies, notably as a collector of etchings, stamps and puzzles.

W. B. Hawkins, Jr., is now assistant general manager of New Riverside Ochre Co., miners of barytes and ochre at Cartersville, Ga. **John Cobb** is assistant superintendent. **J. R. Dellinger** has long been general manager. **Rees Woolford,** formerly with the company at Cartersville, is now in charge of J. R. Dellinger's barytes plant about 11 miles from Athens, Tenn., in the Sweetwater district, where a new deposit has been opened up. Until recently the plant stood at Niota, Tenn., but it was moved from there upon exhaustion of that mine.

Adam A. Boyd has retired from the position of chairman of directors of Mt. Morgan, Ltd., occupied by him since he relinquished the general managership of the company. Mr. Boyd is an outstanding personality in Australian mining. His ability as an engineer has left its mark at Broken Hill, and the resurrection of Mt. Morgan from a derelict mine to a place among the great open-cut properties of the world is entirely due to his courage, foresight, and the high standard of his organizing ability.

Herbert Black, at one time principal of the Zeehan School of Mines, Tasmania, and lecturer in mining and metallurgy at the Otago School of Mines

since 1926, is now acting director of the School of Mines and acting dean of the mining faculty, Otago University, Dunedin, New Zealand, in succession to the late Dr. Arthur R. Andrew.

Stuart R. Zimmerley, expert in ore-dressing methods for minerals for the U. S. Bureau of Mines, has been made regional engineer of the newly created regional office of the Bureau at Salt Lake City, Utah.

Eugene D. Gardner, supervising engineer of the Southwest Experiment Station of the U. S. Bureau of Mines at Tucson, Ariz., since 1925, has been appointed regional engineer in charge of the newly organized Central States office of the Bureau at Rolla, Mo.

W. D. McMillan, of Rolla, who has been assigned as district engineer of the U. S. Bureau of Mines in the Tri-State mining field, arrived in Joplin the middle of July to begin his work in the local mining area. He will be under the direction of **Eugene D. Gardner.**

Lincoln Johnson, vice president in charge of the foreign department of Manufacturers Trust Co., New York, is serving as an advisor to the Metals Reserve Co., in Washington, D. C., which is an affiliate of the Reconstruction Finance Corp. Mr. Johnson is a mining engineer, and had extensive engineering experience before entering the banking field.

John J. Inman, of Webb City, Mo., district manager of the American Zinc, Lead & Smelting Co., has become resident manager of the American Zinc Co. of Arkansas in charge of that company's operations at Batesville, Ark. **Ralph E. Calhoun,** superintendent of the Metaline mines of the parent company at Metaline Falls, Wash., has been transferred to Joplin to serve as assistant district manager of Tri-State operations.

Sir Herbert Gepp, managing director of Australian Paper Manufacturers, Ltd., is making a visit to the United States and Canada. Prior to his association with paper manufacture, Sir Herbert was chairman of the Development and Migration Commission, before which he was successively general manager of Amalgamated Zinc (DeBavay's), Ltd., at Broken Hill, and of Electrolytic Zinc Co., of Australasia, Ltd., Tasmania, for the establishment and development of which enterprise he was primarily responsible.

Stephen M. Shelton, U. S. Bureau of Mines metallurgist and an authority on the recovery and processing of manganese and other domestic ores, has been appointed regional engineer for the Eastern and Southern States, under the Bureau's new streamlined reorganization program. With headquarters at College Park, Md., Mr. Shelton will be in charge of one of the three regional offices recently created by the direction of the Secretary of the Interior. The other two offices are at Rolla, Mo., for the Central states, and Salt Lake City, Utah, for the West. An increased output of ores from domestic deposits, together with enlarged production of processed minerals and greater use of substitutes, for the manufacture of tanks, guns, ships and bombs, is the objective of the Bureau's new program.

OBITUARY

William J. Stainsbury, a well-known Canadian prospector, died recently at Toronto at the age of 71.

John T. Joyce, long identified with mining in Colorado and at one time State Mining Commissioner, died recently at the age of 88.

William Reid, 78, a former assistant manager of the American Smelting & Refining Co., died on July 20 at Salt Lake City, Utah.

J. C. McNabb, mining engineer and metallurgist, died on July 14 at Superior, Ariz. At the time of his death he was mill superintendent for the Magma Copper Co.

Charles Beaton Duckworth, 64, of Magna, Utah, retired master mechanic of the Utah Copper Co., died on June 19. Mr. Duckworth had been master mechanic for the company for 32 years.

Hugh Rice, 53, vice president of the Phelps Dodge Refining Corp. and native of Benton County, Ark., died on Aug. 6, 1942, in New York City.

Francis R. Phillips, chairman of the Central Mining & Investment Corp., died recently. He was one of the best-known of the South African mining group, and was only 54 years of age. In addition to being chairman of Central Mining, Mr. Phillips was a director in many other mining companies.

Joseph Gaskell McNulty, retired mining engineer and consultant, died in New York on July 27. His age was 86. Mr. McNulty was a graduate of King's College (now Columbia University) and attended the Columbia School of Mines and the Royal School of Mines at Freiburg.

Fred Hellmann's distinguished and colorful career as a mining engineer and consultant was ended by death on July 28 at Claremont, Calif. His age was 79. He was born in San Francisco, educated in England and on the Continent, and began his professional career in the United States in 1886 at the Willietta mine, near Chinese Camp, Calif. In 1895 Hellmann went to South Africa, where he became manager of East Rand and, later, consulting engineer for East Rand Proprietary. In 1913 he became manager for Chile Exploration and in 1917 he joined Guggenheim Brothers, also acting as consulting engineer to Chile Copper and Braden, in Chile, and Caracoles Tin, in Bolivia. He was a member of the A.I.M.E. and of several other technical and professional societies.

Colonel William Braden, of Los Angeles, mining engineer and industrialist, long prominently identified with the development of copper properties, died on July 18 at Reno, Nev., at the age of 71. Colonel Braden was among the first to develop low-grade copper deposits, and with Messmore Kendall, put into production the great copper mines of the Braden Copper Co. at Rancagua, Chile, and those of the Andes Mining Co. at Potrerillos, Chile. He not only was a pioneer in the use of quarrying methods in mining low-grade copper deposits, but early adopted the treatment of ores by oil flotation. As an engineer he was engaged for several years in the struggle between the Boston & Montana Co. and F. Augustus Heinze for possession of the Butte Copper Mines. For several years he had been directing mining explorations for the Anaconda Copper Co.

Frank L. Sizer, who for the past quarter century maintained an office in San Francisco, Calif., where he practiced as a consulting mining engineer, died on July 11 at his home in Berkeley at the age of 85. Mr. Sizer was the dean of the mining fraternity on the Pacific Coast and belonged to that group of mining men who played a vital part in the development of the Western mining industry. He was a native of Ottawa, Ill., and a graduate of the University of Michigan. His mining career started in Leadville, Colo. Subsequent work took Mr. Sizer to Butte and Helena, Mont., when the great copper mines were beginning, and to Arizona and California. He finally made his headquarters in San Francisco. At one time he was at Rosario, Mexico. For six years, Mr. Sizer was a director of the A.I.M.E. and he was a member for 42 years. He was also a charter member of the Mining and Metallurgical Society of America and at one time president of the Engineers' Club of San Francisco. Mr. Sizer was a genial, pleasant man, well liked by his neighbors and his fellow mining engineers.

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A LETTER

Spain's Mining Industry

The Editor:

MY DIRECTORS have read with great interest the excellent article on Spain's Mining Industry by Sewell Thomas in your May issue. May I point out that, though scarcity of shipping is largely responsible for the falling off in our deliveries to the United States, the chief cause of our reduced exports is the fact that we do not ship to enemy or enemy-occupied countries, and therefore our large markets in Germany, France, Holland, Belgium and southeastern Europe are closed to us today. So far as concerns Germany (by far the largest customer of this company), deliveries to the country ceased in May, 1939, although the company had running contracts for the delivery of very large tonnages of ore.

I would add that my directors fully agree with the concluding paragraph of Mr. Thomas's article, which really set out the Spanish position as it is today. We hope that the article will be widely read outside the mining profession, and so help to fulfil the author's hope of friendly relations between Spain and the United States with a reasonable exchange of commodities between the two countries.

In conclusion I would say that, as Spanish producers, we can vouch for the truth of Mr. Thomas's statement that there is no danger of the Axis Powers benefiting from the import into Spain of American mining plant and machinery, gasolene, and oil.

J. DAVIDSON, Secretary,
Rio Tinto Co., Ltd.

London

Summary of the

MARKETS

SILVER AND TIN attracted interest in non-ferrous metals circles during July. Early in the month the Metals Reserve Co. announced that its Bolivian tin ore contracts have been amended to provide for settlement on the basis of 60c. a pound of tin contained, f.o.b. South American ports. The original deal called for settlement on the basis of 48½c., United States ports. The sharp advance was decided upon to meet higher costs and stimulate production at Bolivian tin properties. The uplift, however, did not disturb the selling price of tin in this market.

Imports of silver, as metal, in ores, concentrates, bullion, coins, compounds, and semi-processed items were placed under full control by the Director General for Operations of WPB on July 21. Application for permission to import silver must be made on Form PD-222C. Government agencies are not restricted and existing private contracts are allowed to stand. Control was imposed under General Imports Order M-63. Conservation Order M-199 was issued by WPB on July 29 restricting civilian uses of foreign silver and directing supplies into essential production. The measure does not prohibit the purchase of domestic silver by private users. After Oct. 1, 1942, except to fill orders with a rating of A-3 or higher, foreign silver cannot be used in the manufacture of silverware, jewelry, insignia, fasteners, hooks and eyes, buttons, containers, pens and pencils, toilet sets, picture frames, musical instruments, unnecessary electroplating, silverclad metal, insulated wire, and certain church goods. The arts and industry absorbed about 80,000,000 oz. of silver in 1941, and, some observers contend industrial demand at present has increased to around 125,000,000 oz. a year. Because of price regulations, quotations for silver could not be moved upward. Under ordinary circumstances, the price of foreign silver might easily have staged a violent upturn.

Non-essential use of zinc was curbed further in Conservation Order M-11-b, issued July 24. About 100 articles are named in the order, most of which consumed zinc in the form of die castings. Manufacturers of items not on the list will have to hold down consumption of zinc after Sept. 1 to 75 percent of the weight of zinc of Prime Western grade and no more than 50 percent of the weight of other grades used in the corresponding period of 1941.

Authorities in Washington have recog-

UNITED STATES MARKET

1942 July	Electrolytic Copper—Domestic (a) Refinery	Electrolytic Copper—Export (b) Refinery	Straits Tin—New York	Lead—New York	Lead—St. Louis	Zinc—St. Louis
1	11.775	11.700	52.000	6.50	6.35	8.25
2	11.775	11.700	52.000	6.50	6.35	8.25
3	11.775	11.700	52.000	6.50	6.35	8.25
4	Holiday	11.700		Holiday		
6	11.775	11.700	52.000	6.50	6.35	8.25
7	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
11	11.775	11.700	52.000	6.50	6.35	8.25
13	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
18	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
22	11.775	11.700	52.000	6.50	6.35	8.25
23	11.775	11.700	52.000	6.50	6.35	8.25
24	11.775	11.700	52.000	6.50	6.35	8.25
25	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
29	11.775	11.700	52.000	6.50	6.35	8.25
30	11.775	11.700	52.000	6.50	6.35	8.25
31	11.775	11.700	52.000	6.50	6.35	8.25
			AVERAGES FOR MONTH			
July	11.775	11.700	52.000	6.50	6.35	8.25
July			AVERAGES FOR WEEK			
1	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
22	11.775	11.700	52.000	6.50	6.35	8.25
29	11.775	11.700	52.000	6.50	6.35	8.25
July			CALENDAR WEEK AVERAGES			
4	11.775	11.700	52.000	6.50	6.35	8.25
11	11.775	11.700	52.000	6.50	6.35	8.25
18	11.775	11.700	52.000	6.50	6.35	8.25
25	11.775	11.700	52.000	6.50	6.35	8.25

SILVER, GOLD AND STERLING EXCHANGE

1942 July	Sterling Exchange—"Checks" (Nominal)	Sterling Exchange—"90-day demand"	Silver—(c) New York	Silver—London	Gold—London	Gold—(d) United States
1	401.000	(f)	35.125	23.500	168s-	$35.00
2	401.000	(f)	35.125	23.500	168d	35.00
3	401.000	(f)	35.125	23.500	168s	35.00
4	Holiday	Holiday	Holiday	(e)	(e)	Holiday
6	401.000	(f)	35.125	23.050	168s	35.00
7	401.000	(f)	35.125	23.500	168s	35.00
8	401.000	(f)	35.125	23.500	168s	35.00
9	401.000	(f)	35.125	23.500	168s	35.00
10	401.000	(f)	35.125	23.500	168s	35.00
11	401.000	(f)	(e)	(e)	(e)	35.00
13	401.000	(f)	35.125	23.500	168s	35.00
14	401.000	(f)	35.125	23.500	168s	35.00
15	401.000	(f)	35.125	23.500	168s	35.00
16	401.000	(f)	35.125	23.500	168s	35.00
17	401.000	(f)	35.125	23.500	168s	35.00
18	401.000	(f)	(e)	(e)	(e)	35.00
20	401.000	(f)	35.125	23.500	168s	35.00
21	401.000	(f)	35.125	23.500	168s	35.00
22	401.000	(f)	35.125	23.500	168s	35.00
23	401.000	(f)	35.125	23.500	168s	35.00
24	401.000	(f)	35.125	23.500	168s	35.00
25	401.000	(f)	(e)	(e)	(e)	35.00
27	401.000	(f)	35.125	23.500	168s	35.00
28	401.000	(f)	35.125	23.500	168s	35.00
29	401.000	(f)	35.125	23.500	168s	35.00
30	401.000	(f)	35.125	23.500	168s	35.00
31	401.000	(f)	35.125	23.500	168s	35.00
			AVERAGES FOR MONTH			
July	401.000	.....	35.125	23.500	.....	35.00
July			AVERAGES FOR WEEK			
1	401.000	.....	35.125	.....	.....	.....
8	401.000	.....	35.125	.....	.....	.....
15	401.000	.....	35.125	.....	.....	.....
22	401.000	.....	35.125	.....	.....	.....
29	401.000	.....	35.125	.....	.....	.....

Calendar week averages, New York Silver: 4th, 35.125; 11th, 35.125; 18th, 35.125; 25th, 35.125.

(e) Not quoted (Saturday). (f) No quotations.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the World War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. We deduct .05c. from the f.a.s. basis (lighterage, etc.) to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for "High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c per pound over the current market for Prime Western but not less than 1c over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine was 70⅝c. throughout July.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

nized that supply of lead is ample and the emergency pool of 15 percent of domestic production has been dropped for the month of August. The industry believes that some curbs on use of lead will be eased before long.

Demand for copper continues to increase. Owing to censorship, data on production and stocks on hand of all strategic materials are no longer available for publication.

Metals Reserve Co. is now buying surplus domestic production of quicksilver at its Western ore-buying depots, paying on the basis of $192 per flask, New York.

The *E. & M. J.* price index of non-ferrous metals for July was unchanged.

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LONDON TIN—Trading in Standard tin in London remained suspended throughout July.

OFFICIAL LONDON PRICES—COPPER, LEAD, ZINC

Following are the maximum prices of copper, lead, and zinc established by the Ministry of Supply for the British market, in effect since Dec. 18, 1939:

	Per £	Long s.	Ton d.
COPPER:			
Electrolytic, high conductivity	62	0	0
Fire refined, high conductivity	62	0	0
Fire refined, high grade	61	10	0
Fire refined, min. 99.7 percent	61	0	0
Fire refined, min. 99.2 percent	60	10	0
Hot rolled black wire rods	65	10	0
LEAD:			
Soft foreign, duty paid	25	0	0
Soft, Empire	25	0	0
English refined	26	10	0
ZINC:			
Foreign (G.o.b.), duty paid	25	15	0
Domestic (G.o.b.)	26	10	0
Prime Western and debased	26	10	0
Refined and electrolytic	27	5	0
Minimum 99.99 percent	28	15	0

Quotations are for metal delivered to the consumer.

E & M J PRICE INDEX

Weighted index of non-ferrous metal prices. The average for the years 1922-1923-1924 equals 100.

1929	110.33	1935	74.66
1930	82.87	1936	73.45
1931	60.20	1937	90.86
1932	48.26	1938	73.67
1933	59.79	1939	77.71
1934	69.59	1940	79.22
		1941	83.49

	1940	1941	1942
January	80.85	82.48	85.39
February	77.23	82.76	85.90
March	77.94	83.27	85.90
April	77.19	83.48	85.90
May	77.68	83.51	85.90
June	78.85	83.48	85.90
July	76.72	83.60	85.90
August	76.71	83.39	....
September	79.40	83.34	....
October	82.49	83.84	....
November	83.14	84.32	....
December	82.42	84.42	....

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(August 1, 1942)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	15c.
Antimony, domestic, spot, lb 5 ton or more	16.013c.
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	90c.
Calcium, lb., ton lots 97 @ 98 per cent	$1.25
Chromium, 97 per cent grade, lb	89c.
Cobalt, 97 to 99 per cent, per lb	$1.50
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carloads, lb	22½c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$36.00
Quicksilver, flask of 76 lb., 100 flasks or more	$194.43@$198.08
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, carloads lb	14.75c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$10.00
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, 10 to 12% BeO, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry, 48%	
Cr_2O_3, 2.8 to 1 ratio	$39.00
Domestic, 45%, 2.5 to 1 ratio (f.o.b. mines)	$40.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$76.54
Manganese Ore, (foreign) c.i.f. U.S. ports, long ton unit of Mn:	
50 per cent	66c.
48 per cent	65c.
46 per cent	64c.
Manganese Ore, domestic, 48%, f.o.b. mines, l.t. unit	$1.00
Molybdenum Ore, 90%, per lb. of MoS_2, f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	(b) $24.00
Domestic, 65 per cent and upward	(a) $26.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo ; per ton	$55.28

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	4c.
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$5.15
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.43
Sodium Sulphate, bulk, ton	$18.00@$24.00

ALLOYS

Beryllium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, per pound of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$135.00
Ferromolybdenum 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 percent, gross ton	$74.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V, delivered	$2.70@$2.90

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U.S. funds), ton;	
Crude No. 1	$650@$750
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.50
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, long ton:	
Georgia, crude	$9.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.75@$7.25
Bauxite, long ton:	
Domestic, crude, 50 @ 52 percent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and	
Illinois 85–5 per cent, all rail movement, ton	$25.00
Ground, 95 @ 98 percent, bulk, ton	$34.00
Acid, 98 and 1 percent, bulk, ton	$35.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in.	45@65c.
2 x 2 in.	60@85c.
3 x 3 in.	$1.85@$2.05
3 x 4 in.	$2.15@$2.25
3 x 5 in.	$2.50@$2.75
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12c
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.50@$10.50
Vermont, extra white, 200 mesh	$9.50@$10.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

(a) Nominal

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$23.50
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.15

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1941	1942	1941	1942	1941	1942
January	34.750	35.125	23.273	23.500	(a) 402.000	(a) 401.000
February	34.750	35.125	23.341	23.500	(a) 401.864	(a) 401.000
March	34.750	35.125	23.446	23.500	(a) 401.788	(a) 401.000
April	34.750	35.125	23.500	23.494	(a) 401.058	(a) 401.000
May	34.750	35.125	23.457	23.500	(a) 400.981	(a) 401.000
June	34.750	35.125	23.400	23.500	(a) 401.000	(a) 401.000
July	34.750	35.125	23.397	23.500	(a) 401.000	(a) 401.000
August	34.750	.....	23.459	.....	(a) 401.000	.....
September	34.750	.....	23.500	.....	(a) 401.000	.....
October	34.750	.....	23.500	.....	(a) 401.000	.....
November	34.772	.....	23.500	.....	(a) 401.000	.....
December	35.125	.....	23.500	.....	(a) 401.000	.....
Year	34.783	.....	23.439	.....	(a) 401.224	.....

New York quotations for silver other than newly-mined domestic, cents per ounce troy, 999 fine. London pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents. (a) Nominal.

COPPER

	F.O.B. Refinery, Electrolytic			
	Domestic		Export	
	1941	1942	1941	1942
January	11.819	11.775	10.257	11.508
February	11.794	11.775	10.414	11.700
March	11.814	11.775	10.592	11.700
April	11.820	11.775	10.952	11.700
May	11.815	11.775	10.950	11.700
June	11.810	11.775	10.950	11.700
July	11.812	11.775	10.950	11.700
August	11.778	.....	10.950	.....
September	11.775	.....	11.027	.....
October	11.775	.....	11.367	.....
November	11.775	.....	11.200	.....
December	11.775	.....	11.200	.....
Year	11.797	.....	10.901	.....

New York quotations, cents per pound.

LEAD

	New York		St. Louis	
	1941	1942	1941	1942
January	5.500	6.275	5.350	6.125
February	5.602	6.500	5.452	6.350
March	5.765	6.500	5.613	6.350
April	5.850	6.500	5.700	6.350
May	5.850	6.500	5.700	6.350
June	5.850	6.500	5.700	6.350
July	5.850	6.500	5.700	6.350
August	5.850	.....	5.700	.....
September	5.850	.....	5.700	.....
October	5.850	.....	5.700	.....
November	5.850	.....	5.700	.....
December	5.850	.....	5.700	.....
Year	5.793	.....	5.643	.....

New York and St. Louis quotations, cents per pound.

TIN

	Straits New York		Standard, Spot London	
	1941	1942	1941	1942
January	50.154	52.000	256.648	(b)
February	51.293	52.000	264.975	(b)
March	52.067	52.000	270.131	(b)
April	51.981	52.000	269.775	(b)
May	52.166	52.000	267.534	(b)
June	52.685	52.000	262.750	(b)
July	53.481	52.000	258.272	(b)
August	52.385	.....	257.013	.....
September	52.000	.....	256.364	.....
October	52.000	.....	255.842	.....
November	52.000	.....	256.713	.....
December	52.000	.....	(a) 257.625	.....
Year	52.018	.....	261.137	.....

New York quotations, cents per pound. London, pounds sterling per long ton. (a) Average of 6 days; quotations suspended Dec. 9. (b) Not quoted.

ZINC

	St. Louis			
	1939	1940	1941	1942
January	4.500	5.644	7.250	8.250
February	4.500	5.534	7.250	8.250
March	4.500	5.750	7.250	8.250
April	4.500	5.750	7.250	8.250
May	4.500	5.803	7.250	8.250
June	4.500	6.235	7.250	8.250
July	4.516	6.250	7.250	8.250
August	4.719	6.389	7.250	.....
September	6.104	6.920	7.250	.....
October	6.500	7.250	7.942	.....
November	6.500	7.250	8.250	.....
December	5.980	7.250	8.250	.....
Year	5.110	6.335	7.474	.....

St. Louis quotations, Prime Western, cents per pound.

CADMIUM AND ALUMINUM

	Cadmium		Aluminum	
	1941 (a)	1942 (a)	1941	1942
January	89.000	90.000	17.000	15.000
February	82.273	90.000	17.000	15.000
March	89.038	90.000	17.000	15.000
April	90.000	90.000	17.000	15.000
May	90.000	90.000	17.000	15.000
June	90.000	90.000	17.000	15.000
July	90.000	90.000	17.000	15.000
August	90.000	.....	17.000	.....
September	90.000	.....	17.000	.....
October	90.000	.....	15.000	.....
November	90.000	.....	15.000	.....
December	90.000	.....	15.000	.....
Year	88.443	.....	16.500	.....

Aluminum in cents per pound, 99 plus per cent grade. Cadmium, cents per pound. (a) Producers' price, commercial sticks.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1941	1942	1941	1942	1941	1942
January	14.000	14.000	165.846	202.519	36.000	36.000
February	14.000	14.000	170.182	197.272	36.000	36.000
March	14.000	14.602	177.692	197.050	36.000	36.000
April	14.000	15.991	180.077	197.098	36.000	36.000
May	14.000	16.013	180.000	197.300	36.000	36.000
June	14.000	16.013	183.920	194.282	36.000	36.000
July	14.000	16.013	188.577	194.430	36.000	36.000
August	14.000	.....	192.000	.....	36.000	.....
September	14.000	.....	192.440	.....	36.000	.....
October	14.000	.....	193.615	.....	36.000	.....
November	14.000	.....	196.273	.....	36.000	.....
December	14.000	.....	199.654	.....	36.000	.....
Year	14.000	.....	185.023	.....	36.000	.....

(a) Antimony, cents per pound, ordinary brands, in cases; in bulk f.o.b. Laredo, Tex., 14.500 for July; New York equivalent 15.480. (b) Quicksilver, dollars per flask of 76 lb. (c) Platinum, per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1941	1942	1941	1942	1941	1942
January	24.50	24.50	23.50	23.50	24.00	24.00
February	24.50	24.50	23.50	23.50	24.00	24.00
March	24.50	24.50	23.50	23.50	24.00	24.00
April	24.50	24.50	23.50	23.50	24.00	24.00
May	24.50	24.50	23.50	23.50	24.00	24.00
June	24.50	24.50	23.50	23.50	24.00	24.00
July	24.50	24.50	23.50	23.50	24.00	24.00
August	24.50	.....	23.50	.....	24.00	.....
September	24.50	.....	23.50	.....	24.00	.....
October	24.50	.....	23.50	.....	24.00	.....
November	24.50	.....	23.50	.....	24.00	.....
December	24.50	.....	23.50	.....	24.00	.....
Year	24.50	.....	23.50	.....	24.00	.....

Iron, dollars per long ton. F.o.b. Mahoning and Chenango Valley furnaces

News OF THE INDUSTRY

Western Miners Air Labor and Tax Woes to Senators

Operators and representatives insist that excessive imposts are crippling mines and that they cannot meet wage competition of war plants

AT A SERIES OF MEETINGS in Western mining centers, a subcommittee of the U. S. Senate Special Committee on Silver heard mine operators from various mining districts explain how government policies are hampering their capacity to produce essential war materials. Meetings were held at Reno, Nev., July 16 and 17, at Salt Lake City, Utah, July 20 and 21, and at Denver, Colo., July 24. Senators Pat McCarran, of Nevada, and Abe Murdock, of Utah, composed the subcommittee. Also in attendance at the meetings were Dr. Wilbur Nelson, Chief of the WPB mining branch; F. Newell Campbell and I. P. Andresen of the Treasury Department, Washington; James A. White, special assistant to the Silver committee; Henry B. Fernald, chairman of the American Mining Congress Tax Committee; and Julian D. Conover, Mining Congress secretary.

At the Reno meeting, S. H. Williston, president of the Oregon Mining Association, stated that under the present system of taxation, miners are more likely to lose money than to make fair returns on their investments. He cited an Oregon chrome property as an example. J. A. Carpenter, director of the Nevada State Bureau of Mines, stated that the tax burden discourages mine development and that the multiplicity of government agencies dealing with mine problems is confusing to operators. George B. Thatcher, Reno attorney, claimed that 8 percent on invested capital was an inadequate return for mines, and advocated exemption from excess profits taxation for producers of strategic minerals. At the same meeting Senator McCarran urged that U. S. Army troops should be put to work in strategic metal mines.

At Salt Lake City, Governor H. B. Maw of Utah expressed himself thus:

"We have a situation now where the man who has heretofore worked underground as a miner can now earn twice as much and more in a defense industry.

"Some unskilled laborers actually are receiving two and a half times as much money for their work as what we would call a normal wage.

"The mining industry either must increase wages to compete with defense industry or metals production will go down. And if mining wages are raised to meet competition many units of the industry will lose money and may go broke."

Other witnesses testifying in the same vein were George Ryan, Colorado mine operator; Paul H. Hunt, mine manager, Park Utah Consolidated; and Donald Callahan, president of Callahan Consolidated, of Wallace, Idaho. Callahan stated that Idaho mines were already 10 to 20 percent short of labor.

Testifying before the committee at Denver, Conover said:

"We cannot compete for labor with war contractors operating on a cost-plus fee basis who can pay almost any wages to attract our men and then charge these wages into their present contract cost."

Robert S. Palmer, secretary of the Colorado Mining Association, attacked the proposed excess profits tax on mine operations and stated that a one dollar per ounce price for silver, recommended by McCarran, would go far toward enabling mines to produce necessary metals.

C. L. Bradbury, president of the New Mexico Miners and Prospectors Association, and Charles A. Willis, representing the Arizona Small Mine Operators Association, also testified, highlighting the detrimental effect of tax burdens on production of essential metals.

Bureau of Mines to Build Electro-Laboratory

THE U. S. BUREAU OF MINES has announced that it will build a $500,000 electro-development laboratory in the Pacific Northwest to study the recovery and processing of minerals by electro-methods. The project will utilize current from Bonneville or Grand Coulee dam, and will be located within 200 miles of both power sites. Construction will start as soon as a site has been chosen.

Chief objectives of the plant are stated to be "improved methods of recovering magnesium and aluminum from the plentiful natural resources of that area, together with research in the processing of tungsten, chromium, manganese, vanadium, and other strategic and critical materials." The plant will be named the Northwest Electro-Development Laboratory and will employ from 40 to 50 metallurgists and assistants.

Bureau Assists Pillar-Robbing in Tri-State

AFTER geophone observations made by Bureau of Mines engineers, under the direction of C. F. Jackson, former chief mining engineer, and McHenry Mosier, mining engineer, Tri-State operators are preparing to remove 13 pillars, estimated to contain 30,000 tons of ore. Geophone observations, indicating that the pillars could be removed without collapse of the roof, were made according to the technique developed by Leonard Obert, described in several Reports of Investigations published by the Bureau of Mines in recent years.

Labor Board Forces BH&S to Recognize Union

SUBSEQUENT to an election held by the National Labor Relations Board among the employees of the Sullivan zinc plant of the Bunker Hill & Sullivan Mining & Concentrating Co., at Kellogg, Idaho, the board decreed that the company must recognize Local No. 18 of the International Union of Mine, Mill and Smelter Workers as the exclusive bargaining agent for the workmen in the zinc plant. Decision was made in spite of the protest of the company over alleged irregularities in the conduct of the election.

Minister Says Britain Will Not Return to Gold Standard

SPEAKING in the House of Lords at London, on July 22, Viscount Simon, Lord Chancellor, stated that he had heard "no whisper of any intention" that Great Britain should return to the gold standard after the war. In answer to a question, the Lord Chancellor said:

"Our return to the gold standard after the last war was not a very happy one," and also added, "I can say with the government's authority that it is the determination of the government that these tragic errors shall not be repeated."

Inland Steel Accepts WLB Order Under Duress

FOLLOWING similar action by Bethlehem, Republic, and Youngstown, the Inland Steel Co. accepted the order of WLB to bow to the demands of the SWOC for a wage increase and a "union security" contract before July 28. Acceptance was made, despite the company's belief that the decision was unfair, because of the importance of full steel output for the war effort.

The Inland management advised its stockholders as follows:

"In the name of patriotism, Inland is compelled to do a thing which it believes to be wrong, because the alternative would interfere with war production.

"The Steelworkers Union has deliberately chosen the period of the war to seek from the Government special privileges which it has never been able to obtain by its own efforts. . . .

"The American public does not realize the extent to which the Steelworkers' Union has employed physical violence in getting and keeping members. It does not realize that large numbers of men have joined and remained in the Steelworkers Union through fear and fear alone." . . .

"Theoretically, each worker is given a chance to resign during fifteen days. But how is he to know what his rights are, and who is to tell him how to resign, and, if he joined through fear and has stayed in through fear, who is to assure him that it is now safe to resign?

"The Company itself was allowed only ten days within which to reach a decision. In that time it could not even consult with its stockholders.

"And facing the Company during this ten-day period were two direct threats. The Steelworkers threatened to strike if the Company did not comply. The War Labor Board threatened to invoke the full war power of the President to compel the Company to comply, meaning that the Company's plants would be taken from it. The Company had no alternative. It had to comply.

"Seldom in the history of democratic institutions has there been such an arbitrary exercise of power by a Government agency. Inland's record of devotion to the nation's cause is unquestioned. And now it is compelled, by threat of confiscation, to forego a right never heretofore denied, a day in court."

National Zinc Receives Army-Navy Emblem

THE NATIONAL ZINC CO., of Bartlesville, Okla., was one of the first 20 industrial organizations to receive the joint Army-Navy Production Award. This recognition, bestowed in July, is given for outstanding achievement in the war effort. Firms honored by the award are permitted to fly a pennant of swallowtail design, having a gold wreath of oak and laurel leaves surrounding the letter "E" in white, and a white border. Background is blue and red, divided vertically, with the words "Army" and "Navy" superimposed on the red and blue sides, respectively.

WPB Issues New Curbs on Use of Zinc

DRASTIC NEW RESTRICTIONS on the use of zinc were announced with issuance of Conservation Order M-11-b, effective July 24.

Articles on the prohibited "List A" of the order are largely die castings. Until Sept. 1, not more than 50 percent of the average monthly weight of zinc used in 1941 in the manufacture of any article named in the order may be consumed for that purpose. Effective Sept. 1, no person may process any zinc on "List A".

Manufacture of items not on "List A" during any calendar quarter will be held down to 75 percent of the weight of zinc of Prime Western grade or more than 50 percent of the weight of zinc of any other grade. The base period will be the corresponding quarter of 1941.

War applications of zinc and Governmental contracts are exempted, as are its use in safety equipment, chemical and corrosion prevention, and in research laboratories.

The order applies to metallic zinc, both new and scrap, and to zinc dust for sherardizing. It does not apply to zinc dust for other purposes or to zinc oxide.

WPB Asks Conservation of Scrap Crucibles

STATING that the graphite situation is serious, Fred L. Wolf, chief of the Graphite section, War Production Board, requests that industry should save and set aside scrap crucibles containing graphite or silicon carbide. Tercod and Syncarb crucible scrap should be kept separate from other crucible scrap.

This request is made in anticipation of a scrap collection program on the part of the government, wherein central stations will be set up to which scrap will be shipped for processing.

Federal Will Operate Manganese Plant

THE Federal Mining & Smelting Co., subsidiary of American Smelting & Refining Co., will build and operate a manganese concentrator and sintering plant at Deming, N. M., for Metals Reserve Co. The plant will handle manganese milling ores containing from 15 to 35 percent manganese. Deming is one of the depots established by Metals Reserve for the purchase of low-grade milling ores (*E&MJ, July 1942*, p. 42).

Mexican Mine Profits to Enjoy Tax Exemption

TO ENCOURAGE the development of metals and minerals urgently needed for the United Nations' war effort, President Camacho of Mexico has decreed tax exemption for income from new investments in mining. To qualify for exemption, the investments must not bear interest.

Growing Use of Silver in Electrical Equipment

ALMOST EVERY MOTOR, generator, and transformer, as well as other apparatus made by the General Electric Co. for the war, contains at least a little silver, according to Harry A. Winne, vice-president.

In many cases the use of silver adds to the cost, a consideration secondary to production at the moment. Mr. Winne, who is in charge of G-E apparatus design engineering, believes that in such instances, its use is probably temporary.

On the other hand, the use of silver in current-carrying contacts and in brazing alloys frequently results in an improvement in quality sufficient to justify the greater cost, he said, and so for these purposes its use will not only continue after the war but probably will increase.

Government Seeks Mining & Metallurgical Engineers

THE U. S. Civil Service Commission is in urgent need of men with experience in all phases of mining and metallurgical engineering, salaries ranging from $3,200 to $4,600 per year. Vacancies in these positions exist both in Washington, D. C., and in the field.

Interested and qualified persons should apply under Examination Announcement No. U-173 for Mining and Metallurgical Engineers. There is no written test. All applicants will be rated on the basis of their education and experience and such other requirements as are set forth in the examination announcement.

WPB Restricts Use of Alumina and Bauxite

BECAUSE of increasing shipping difficulties and the skyrocketing plant capacity for making aluminum, the War Production Board in July placed both bauxite and alumina under strict allocation. Henceforth, manufacturers of chemical salts will be required, in so far as possible, to use high-silica ores so that the better ores can be reserved for producing metal. Under the program set up by Order M-1-h, both Arkansas and imported bauxite containing less than 15 percent silica will be allocated primarily for the manufacture of aluminum, abrasives, and aviation gasoline. Both high and low grade ores mined in Alabama, Georgia, Virginia, Tennessee, Mississippi, and other states will be split among chemical and refractory requirements.

Anticipating depletion of bauxite reserves, the Advisory Committee on Metals and Minerals of the National Academy of Sciences has recommended that WPB start production of alumina from clay and other low-grade aluminous materials.

TAKE a good look at this gloating scoundrel . . . our evil enemy . . . the Axis. He's smirking, but American teamwork, combining conservation *and* production, will wipe off that smile in double-quick time. But every mining engineer and maintenance expert must gear production to the limit, and conserve his vital production tools. We, as makers of Exide Batteries, urge regular battery care. Follow these simple basic rules, and—*Save to Win!*

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ARIZONA

Producers, Inc., Convert to Lead and Zinc

Tennessee-Schuylkill will double capacity —Davenport has stabilized operations— Swansea increases copper shipments

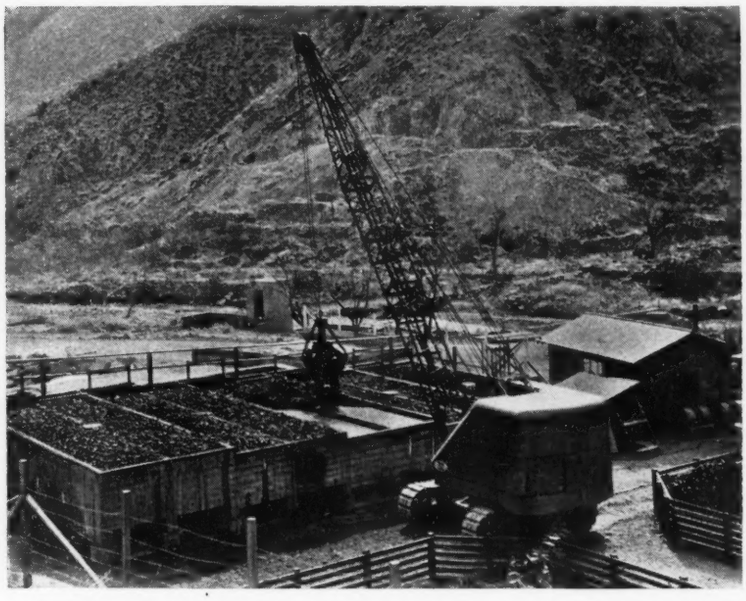
▶ Producers, Inc., H. W. Thorne, general manager, which has been operating a custom gold mill for several years, are now making preparations to change their operations to handle lead and zinc ores. The company is examining a number of zinc-lead properties in the Cerbat Mountains from which a supply of ores can be furnished for the rehabilitated plant. This is not being done because there is a dearth of gold ores in the district but because priorities for gold operations are hard to obtain, whereas for the strategic minerals they can be more easily secured.

▶ Ogden C. Chase, Las Vegas, Nev., president of the Emerald Isle Copper Co., holding properties 15 miles north of Kingman, in the Cerbat Range just below the old camp of Mineral Park, has made application for a $450,000 RFC loan. The company now has a 250-ton leaching plant nearing completion and desires the loan to complete the construction of the plant and to diamond-drill the extensive secondary deposit of copper. Drill exploration up to the present time has determined over half a million tons of ore, partly exposed at the surface, yielding an average assay value of 2.5 percent copper. Under the proposed development, plant will have new mining equipment, power units, acid plants, housing and other improvements.

▶ The Davenport Mining Co. is becoming one of the stable producers of lead and zinc concentrates in the Cerbat Mountains. A large tonnage of zinc-lead ores is now being obtained for the company mill from the La Fontaine property near the top of Stockton Hill. Carroll Farley, one of the owners of the property, states that the company has built an excellent road to the property and is hauling a considerable tonnage to its mill near the Oro Plata mine in Todd Basin. Ogden C. Chase, of Las Vegas, Nev., is head of the company and is contemplating an increase in capacity of the mill to handle other lead-zinc ores.

▶ The Swansea mine, near Bouse, has increased its shipments of copper ore. The Swansea Development Co. is operating the property. The vein shows a width of 14 ft., and the ore is being taken mostly from the 200-ft. level. A 250-ton flotation mill is on the property, power being generated by a steam turbine. Water is pumped from the Bill Williams River, a distance of four miles, through a 4-in. pipe line.

▶ Victory Mines & Milling Co. has taken over the old Magma mine, at Chloride, Mohave County. The property is equipped with a 75-ton flotation mill which was successfully operated by the former owners for several years. The mill is now being converted to a more selective process whereby the lead and zinc can be separated. The ores also contain values in gold and silver.



Crawler crane handling scrap iron and precipitated copper at Morenci plant of Phelps Dodge

▶ The United Lead-Zinc Mines, Inc., has recently been organized to operate the Lead Carbonate and Columbus group of mining claims situated in the Hualpai Mountains about 15 miles southeast of Kingman. The company is headed by Maurice Katleman, of Los Angeles. J. H. Hoffman, prominent mining man of Mohave County, is secretary-treasurer. A small crew of men is already at work on the properties and a shipment of lead ore will be taken out at once. The galena ore carries excellent values in gold. Both of these groups of claims contain potential tonnages of lead ores, and the grade now being taken out indicates that the properties will be permanent shippers.

▶ A. P. Root of Durango, Colo., is operating the Diamond Joe mine, east of Wickenburg, under lease. About 60 tons per week of lead-silver ore is being produced, and the management plans to double its production soon. The shipments go to the El Paso smelter. A development plan is also being executed along with the regular mining operations.

▶ To date 32 cars of siliceous fluxing ore has been shipped from the Miller-Hansen group of claims in the Oro Blanco district near Ruby. H. W. Miller, of Tucson, is owner of the group. The property is opened by an inclined shaft to a depth of 100 ft. and approximately 300 ft. of drifting has been done.

▶ The Republic mine, near Dragoon, is shipping a carload of copper-zinc ore daily to the Shattuck Denn concentrator at Bisbee.

▶ The Gladiator mine, at Crown King, is shipping about 20 tons of ore daily to the Clarkdale smelter. E. M. Moores, president of the operating company, is rehabilitating the Golden Belt mill and will then step up production to 50 tons. Values are in copper, silver and gold.

▶ It is expected that the new 2,500-ton flotation plant of the Bagdad Copper Corp. at its Hillside property will be ready for production about December of this year. The water supply for the new mill will be piped 7 miles from Burro Creek, where an ample supply is obtainable. It is also planned that electrical energy will be transmitted from the generating plant at Parker dam, on the Colorado River. Twenty-five houses are being built for the accommodation of employees. A three-compartment shaft is now being sunk and will go to a depth of 480 ft. In the meantime, the old plant of 250 tons daily capacity continues to operate, turning out a 45 percent copper concentrate.

▶ Considerable diamond drilling is now being done for the purpose of opening up further reserves of lead-zinc ores in the Tennessee-Schuylkill mine, at Chloride, in Mohave County. J. L. Fisher, general manager of the property, is planning to increase the present capacity of 150 tons daily. The company usually carries about 100 men on its payroll, but is having trouble in securing miners and other laborers because of employees leaving for defense work which offers higher wages. The lead-zinc ores carry both gold and silver.

▶ Sam Knight, under his lease on the Christmas mine, near Winkelman, is shipping about 3,000 tons of copper ore monthly. The ore is estimated to carry about 2¼ percent copper. About 45 men are carried on the payroll.

▶ Shattuck Denn Mining Corp., of Bisbee, has bought the properties of the Iron King Mining Co. H. F. Mills, formerly general manager of the Iron King, succeeds as manager of the property for the new owners. The property has a production record of 1,500,000 lb. of zinc and 400,000 lb. of lead. The ore also carries gold and silver values.

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Today, with mining recognized by the War Production Board as essential to the war effort of the United States, this company, together with other manufacturers serving the industry, is receiving full cooperation in making available the new equipment and replacement parts necessary to maintain safe mining operations at high levels for Victory.

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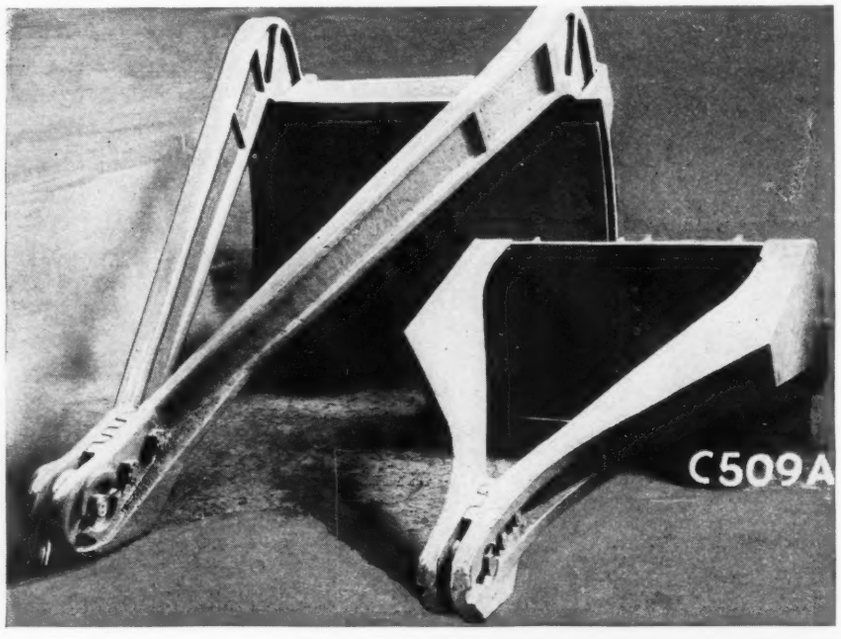

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▶ARIZONA

▶The Berger tungsten mine, in the Aquarius Range 70 miles southeast of Kingman, in Mohave County, has recently secured an additional RFC loan of $18,000 with which to complete its development plan. The property previous had a $20,000 RFC loan. W. H. Berger, of Kingman, is in charge of operations. With the completion of the present development the mine is expected to be ready for a considerable and steady production. The ore is mostly wolframite of a good milling grade.

▶The Golden Gem mine, 15 miles north of Kingman, is operating its 50-ton plant on a one-shift basis. Ralph R. Langley, owner of the property, is contemplating taking over a lead and zinc property near the Golden Gem and increasing the capacity of the plant to 100 tons. Meanwhile, some lead veins on the property are being opened and it is expected that a sufficient supply of ore will be obtained to work the mill on a 24-hour basis.

▶A. E. Blackmer, president of the Polaris Mining Co., a Utah corporation, is developing a group of manganese claims north of the Colorado River in Mohave County. A large deposit has been exposed, and the company contemplates making an application for an RFC loan to put the property in production.

NEVADA

Several New Tungsten Properties Opened

Gabbs Valley magnesite now being shipped — Eureka-Keystone mine reopening —Imlay mine producing antimony

▶Scheelite claims in the Eugene Range, northern Pershing County, have been acquired under option and are being developed by the Callahan Zinc-Lead Co., under direction of P. A. Rockne, formerly in charge of the Callahan company's Simmons mine, in Oregon, now addressed at Mill City, Nev. A road is being built to the claims, at the head of Pole Canyon and three miles north of the Nevada-Massachusetts Co. tungsten property, second-largest United States producer. Leverett Davis, in charge of Callahan's Idaho operations, with James B. Eldridge, of Boise, acted for the company in dealing with the owners, Frank O'Leary, H. G. Murphy, and Harry Brechtel—all of Winnemucca. Shipments will be made at once for mill tests.

▶First of four projected units, completed five months ahead of schedule, began production in early July of magnesium oxide at the Gabbs Valley magnesite deposits of Basic Magnesium, Inc. The quarried magnesite, by a series of conveyor belts passes to crushers, flotation, drying floor, and calcining furnace, reducing weight by some 55 percent. Plans for truck transportation 350 mi. south to the magnesium plant near Boulder dam have been abandoned. For the present the calcined product will be trucked 32 mi. to the Luning rail point

Nevada Consolidated Copper Corp., Ruth, Nev. View of Monitor shaft. Emma shaft of Consolidated Coppermine Corp., at left

▶NEVADA

and shipped by way of Salt Lake City, about 1,100 mi., to the main plant. The latter, midway between Boulder dam and Las Vegas, will begin production of metallic magnesium in August, according to Howard P. Eells, Jr., president of Basic Magnesium, Inc., Hanna Building, Cleveland, Ohio, and by Major C. J. P. Ball, of London, vice-president of Basic Magnesium, Inc., and chairman of the board of Magnesium Electrons, Ltd., British affiliate in the Nevada enterprise, who came by plane from England to participate in ceremonies marking the start of plant production at Gabbs Valley. Whereas these vital war projects, involving an estimated $73,000,000 allocation of Defense Plant Corp. funds under "cost-plus" contracts, have depleted the metal mines' labor supply, mining men generally have deplored criticism of Basic Magnesium management in view of the progress that has been achieved.

▶A development crew is engaged in reopening the old Eureka-Keystone mine, a mile south of the productive camp of Eureka, the property having been acquired under lease and option by James O. Greenan, of Reno, who is producing mercury from his furnace at Bottle Creek in Humboldt County. Ore of the Eureka-Keystone contains gold and lead and will be trucked to the McGill smelter of the Nevada Consolidated Copper Corp. New work has been directed by James E. Atkinson, of Reno, who is geologist for the various Greenan interests.

▶On recommendation of the U. S. Bureau of Mines, Metals Reserve Co. has established a depot at Battle Mountain, Lander County, on the Southern Pacific main line, to purchase small lots of manganese ore and concentrates. Glenn G. Gentry, of Battle Mountain, has been appointed supervising engineer. No available manganese deposits are known to exist within trucking distance of the depot. Late reports stated that no ore of any kind had been delivered at the station.

▶The Pass Creek antimony mine in the Pine Forest Range in northern Humboldt County has been leased by G. E. Hoagland, of Winnemucca, and associates from the Nevada-California Gold & Antimony Co., Inc. New mine equipment has been provided and the operators are planning to construct a mill.

▶Antimony ore, as stibnite, is being produced from the old Imlay mine, in Pershing County, an early-day producer of gold, silver, copper, and lead. The main shaft has been unwatered and repaired to the 200-ft. level, where a drift was said to have followed a good stoping width of ore sampling up to 50 percent antimony. The mine has been taken under option from Dan Pavich, of Imlay, by William White and Harris Hansen, of Reno, and William Fox, of Imlay, who have formed the Rose Mining Co.

▶Formerly productive tungsten properties in the Pilot Range, eastern Mineral County, including the Gunmetal and Desert Scheelite groups, are being reopened under an option agreement by J. H. Marsman, head of Marsman & Co. Inc., who escaped from Japanese captors at Hongkong and who now has his main office in San Francisco. J. O. Enberg is directing engineer. The Desert Scheelite property has been equipped with a 60-ton mill, for which added power must be provided.

▶Surface oxidized ore of the Getchell Mine, Inc., in Humboldt County is reported nearing exhaustion and the mill will continue to treat 1,000 tons per day of sulphide ore, which is subjected to a primary low-temperature roast in two 7½x260-ft. rotary kilns before entering the cyanide circuit. A tungsten plant, designed to treat 250 to 300 tons of scheelite per day, has been completed within the mill structure, and, in addition to scheelite developed on Getchell ground, will handle ore from nearby property developed in late months by the U. S. Vanadium Corp. under direction of Clarence H. Hall, of Winnemucca. Concentrate will go to the new Salt Lake City plant, built and operated by U. S. Vanadium Corp. for the Metals Reserve Co. Getchell Mine's Cottrell

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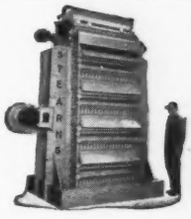

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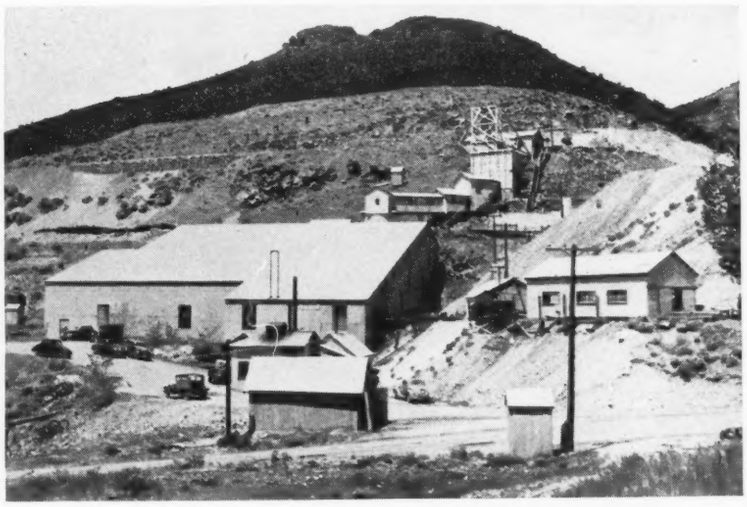

Main shaft and 125-ton cyanide mill of Sutro Coalition Mines Co., Gold Hill, Nev.

▶NEVADA

plant is producing a substantial quantity of arsenic.

▶Property known as the Swales Mountain copper mine, in which lead and zinc had been exposed below copper-stained outcrops in earlier work, embracing 17 claims and situated 21 miles north of Carlin, in Elko County, has been reopened under a lease and option by John N. Richardson, of Alameda, Calif. Sampling by Roger Dering, engineer, was said to have shown a 5-ft. face on the 250-ft. level of good all-sulphide zinc-lead ore.

▶A 150-ton tungsten mill began operating in mid-July on property of the M.G.L. Mining Co. in the Nightingale district, east of Winnemucca Lake on the Washoe-Pershing county line. Development, in progress for several months, is said to have opened a large volume of scheelite of uniformly high grade. The property was acquired from Richard H. Cowles, Reno cattleman and mine owner. Arthur Letts, of Los Angeles, is head of the company and Roy A. Hardy, of Reno, is consultant.

▶Highly siliceous, low-grade gold ore in waste dumps of the Clermont mine of the Goldfield Cons. Mines Co. at Goldfield is being shipped for tests to the A.S.&R. smelter at Garfield, Utah. It was indicated that 2,000 tons may be utilized as a smelter flux. The ore was mined around four years ago by the Eastern Exploration Co.

▶Operating a small retort plant that treats four tons of ore per day at Kitten Springs, Pershing County, C. N. Williamson and Charles Gartiez, of Winnemucca, have opened high-grade cinnabar from which they claim to have been recovering three flasks of mercury daily.

▶Lead-zinc-silver property and 60-ton flotation mill of the Silver Palace Mines Inc. at Grantsville, Nye County, have been taken over by Ira L. Kent, mine owner and merchant, of Fallon, from Capt. W. A. Barrows, Pacific clipper pilot, and California associates.

UTAH

High Taxes and Labor Shortage Affect Mines

Operators complain to Senate subcommittee—USBM drilling alunite deposits—WLB will fix Utah mine wages

▶Utah mining operators marshalled facts before a subcommittee of the U. S. Senate Committee on Silver in a special hearing at Salt Lake City on July 20 and 21 to describe the conditions operating against increased metal production. The hearing was conducted by Senators Pat McCarran, of Nevada, and Abe Murdock, of Utah, to analyze the effects of the pending tax bill on specific enterprises. Dr. Wilbur Nelson, chief of the mining division of the WPB, and F. N. Campbell and L. P. Andersen, tax experts for the U. S. Treasury Department, attended the hearing. Governor Herbert B. Maw explained that mines had been forced to increase wages to compete with war industries at a time when the government had placed a ceiling upon metal prices. The result has been a loss of skilled help and a reduction in output per shift. Paul H. Hunt, mine manager of the Park Utah Consolidated Mines Co., cited the case of one mine, where underground employment had dropped from 291 men underground in January, to 141 men in June, with a drop in production per shift for the same period of 1.28 tons to 0.87 tons per man. Julian D. Conover, secretary of the American Mining Congress, outlined what mining industry leaders believed to be necessary alterations in the revenue measure pertaining to the percentage depletion allowance and excess profits tax. S. H. Williston, president of the Oregon Mining Association, cited examples of discrimination against the quicksilver mining industry, whereby a less efficient metallurgical process is sometimes advantageous to the operator because of the depletion factor. W. J.

O'Connor, manager of the Utah department of the American Smelting & Refining Co., testified that ore receipts at the Garfield plant, not including Utah Copper Co. concentrate, dropped from 711,976 tons in 1937 to 588,521 tons in 1941 and values from an average of $21.68 to $17.51 a ton. Receipts at the company's Murray lead plant have followed the same general pattern and stocks of siliceous ores had been depleted almost to the vanishing point. E. H. Snyder, operator of mines and metallurgical plants, stated that the 5 percent transportation tax in the proposed 1942 revenue bill would really amount to a stiff production tax. Mr. Snyder cited figures to show how this tax would affect revenues by mounting to approximately 40 percent of operating profits for the first five months of 1942 on an Idaho lead-zinc operation. Others testifying included R. D. Leisk, general manager of the Sunshine Mining Co., of Idaho; Carl J. Trauerman, secretary of the Montana Mining Association; Henry B. Fernald, chairman of the American Mining Congress tax committee; George H. Watson and Harry S. Joseph, Salt Lake City operators, and Harold Bowman, secretary of the Chamber of Commerce mining committee.

► The War Labor Board, at Washington, D. C., will pass upon the demands set forth in the new contract proposed to operators of Utah non-ferrous metal mines by the International Union of Mine, Mill and Smelter Workers. Announcement to this effect was made by Robert Abelow, principal mediation officer of the board, at the end of a two-day conference in Salt Lake City closing July 15. On the same day notices were said to have been posted by Tintic Local No. 151 calling a strike for July 21 unless all men employed were union members by that time. Prompt investigation of the strike threat was promised by Dan Edwards, president-secretary of the International Union, district 2. As the result of the meeting with Mr. Abelow, it was reported that there should be no strike pending the board's decision. Any increase in basic wage rates granted by the board shall be deemed effective as of July 1, 1942, when the old contract expired. The demands for blanket wage increases, vacations with pay, and closed shop affect 5,000 employees and 14 Utah metal mine and smelting companies.

► Diamond drilling of Marysvale alunite deposits has been started by two contractors for the U. S. Bureau of Mines. The Pennsylvania Drilling Co., of Pittsburgh, Pa., is drilling on the Mineral Products Co. ground and the Boyle Drilling Co., of Salt Lake City, on the Winkelmann holdings.

► Operations were resumed on July 15 at the Murray smelter of the American Smelting & Refining Co., after a shutdown of two and a half months to build up the stockpile, announced W. J. O'Connor, manager of the Utah department.

► New Park Mining Co. is developing a good-sized stope of ore on the new 910 level of the shaft being sunk from the Mayflower tunnel, reports W. H. H. Cranmer, general manager, of Keetley, Utah. One shipment averaged $34 a ton. Sinking is proceeding to the 1,030 level.

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COLORADO

New Concentrator for Ouray District

Highland Mary resuming operations—Lamartine transferring activity to Montezuma—Labor shortage at Cripple Creek

▶ The Smuggler mine, near Silver Plume, has uncovered a large body of silver-lead-zinc ore. George Rowe, in charge of operations, has been employing over 25 men for the past year working this property for the Mile High Mining Co.

▶ J. M. Bradley, president of Highland Mary Mines, operating near Silverton, states that they are now making minor repairs prior to resuming operations. Frank L. Kennicott, formerly of the Summit King mine, in Nevada, will have charge of operations. A development program has been outlined which should see production of war metals greatly increased. This company incorporated in 1934 in Colorado, and secured a long-term lease and an option agreement on the Highland Mary and Shenandoah groups from the now defunct Highland Mary Mine & Milling Co., and the old Shenandoah Mining Co. The properties consist of gold-silver-lead-copper claims, 16 patented, and a millsite in Cunningham Gulch, 9 miles east of Silverton. Development consists of six tunnels aggregating 13,000 ft. with the greatest depth 2,400 ft. Equipment includes a hydroelectric power plant and two aërial tramways, 1,400 and 1,600 ft. long. The mill is of 100-ton capacity.

▶ Joe Ruth, mill operator and designer, has taken over the Capital Prize mine, at Georgetown, and this will soon be added to the larger producers of this section.

▶ Shattuck Chemical Co. has finished its Pueblo Bell shaft 75 ft. below the 200 ft. level and is continuing with an additional 75 ft. of sinking. New levels will be established at each of these new depths. The shaft has been in a good grade of tungsten ore for the entire depth of sinking.

▶ Superintendent Mack of the Lucky Strike mine, at Kokomo, is shipping about five cars of high-grade galena ore, which measured a 10 to 12 ft. width of solid galena in a flat vein. The ore is shipped direct to the smelter at Garfield, Utah, according to A. R. Rhine, manager.

▶ Arthur C. Daman, president of the Denver Equipment Co., states that for over a year the company has been sampling and testing the different ores of the Ouray district and has now arrived at a suitable method of handling. Construction of a 100-ton mill on the site of the Wanakah smelter, to treat custom ores, is under way.

▶ Lamartine Mines, Inc., operating a mine and mill above Idaho Springs, are transferring their operations to the Montezuma district, where the organization has taken over some valuable lead and zinc properties. This is only a temporary shutdown of the Trail Creek mine, which is one of the best gold producers in the State. The property is being left in condition so that it can be opened again at the close of the war. Daily production at the new location will give about 25 tons of zinc concentrates and 5 tons of lead concentrates daily.

▶ The Freeland tunnel, at Dumont, now known as the McCleeland tunnel, is being operated by men from the Colorado School of Mines. The Freeland vein proper is near the head of Trail Creek, and is opened by an inclined shaft running down to and through the various tunnel drifts, to the lowest workings.

▶ Mills and Dyer, operating the Empress property, at Montezuma, have installed a compressor and drills. They are now equipped to produce a car of ore weekly. The last car returned over $1,100. This property is opened by a 600-ft. tunnel, driven years ago. The streak of ore struck by the present operators occurred about 400 ft. from the portal, where stoping is now under way.

▶ The Diamond tunnel, at Georgetown, is being cleaned out by lessees of the Silver Plume Mines, Inc., Richard H. Abramawicz and Stanley Keh, with John L. Donahue in charge. The work is nearly completed to the Guenzi shaft, some 1,680 ft. Mill tests are being made on the caved stope material and the dumps. The lease includes the Seven Thirty and Dives Pelican groups of claims and the 100-ton Commonwealth flotation mill. John Smith, president of the Silver Plume company, is superintendent for the lessees.

▶ Dredging operations will be started soon by the Timberline Dredging Co. at its No. 2 dredge on the Snowstorm placers between Fairplay and Alma. This dredge will handle 10,000 cu.yd. of gravel per day. The No. 1 or Continental dredge will handle some 4,000 yards daily. H. J. Ackley, superintendent, has an experienced crew, mostly from Breckenridge.

▶ The Blue River Dredging Co. has started operation of its gold dredge, and will operate 24 hours daily seven days per week during the dredging season. The company has enough sheet metal, material, and supplies on hand to operate for two years.

▶ A labor shortage exists in the Cripple Creek district. At present the district is short over 40 percent, and the mill at Colorado Springs is short some 20 percent, because of the war call for men.

▶ Connection with the winze level of the Portland mine was made the first half of June, when a crew of Carlton tunnel shot through from the crosscut run from the new shaft. This connection was perfect as to line and grade. The level is now finished and crews are slabbing out for the new station. Completion of the crosscut and connection with the bottom level of the mine has resulted in good ventilation and a comfortable working temperature.

▶ New leases on the Vindicator property, at Cripple Creek, have been granted to Tom Hafford and associates and to Athel Goure and Gus Leaf. This property of the United Gold Mines Co. continues its heavy shipments. Some 1,500 tons were shipped by J. S. Anderson, superintendent, last month. The Vindicator and associated properties, the Theresa and Hull City, have a good amount of ore in sight and are operated entirely through split-check lessees.

▶ The new fluorspar mill of the General Chemical Co. has been running for the past couple of weeks at Boulder, and operations will soon be at capacity.

▶ C. R. Snider, who opened up a feldspar deposit on his homestead on Beaver Brook, has shipped some four hundred tons and is now getting the property into condition for heavy production.

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WASHINGTON

American Zinc Expands at Metaline Falls

Pend Oreille reports on operations—Victory Copper developing vein near Newport—Knob Hill has good orebody

▶ Pend Oreille Mines & Metals Co., Lewis P. Larson, Spokane, president, mined and milled 243,323 tons of ore in the fiscal year ended April 30, 1942. The average metal content of the shipments was 77.42 percent for lead concentrates and 61.23 percent for zinc concentrates. Development in the year consisted of 1,600 ft. of drifts, 630 ft. of raises, 230 ft. of incline shafts, and 22,993 ft. of churn and diamond drilling. The company's hydroelectric plant generated 9,183,000 kw.-hr. Net profits, transferred to surplus, amounted to $48,366.

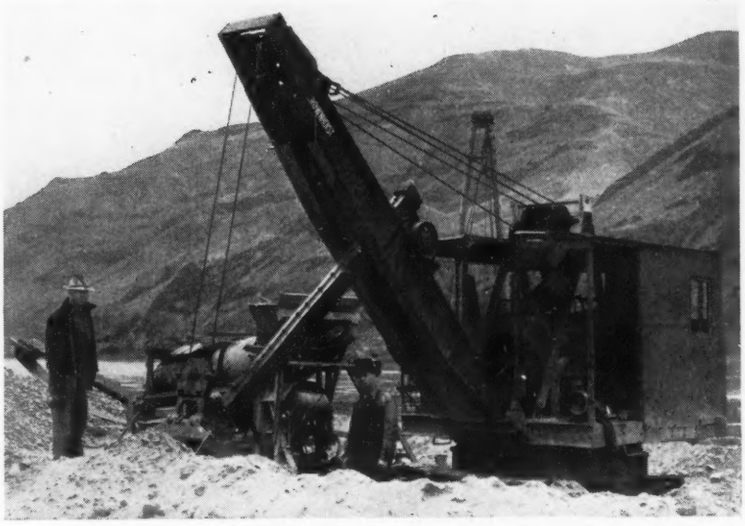
▶ American Zinc, Lead & Smelting Co. has had a large group of claims staked on Slate Creek, 25 miles northeast of Metaline Falls and 5 miles south of the international line. Many years ago Bunker Hill Mining & Concentrating Co. sought ore above the shale in this property but failed to find deposits of importance. American Zinc, it is understood, will attempt to locate ore below the shale which goes to a depth of 100 to 350 ft. In this district American Zinc has acquired an option on the Davenport-Troyer group of claims between Styx Creek and the Leadhill camp and will explore by diamond drilling. Also in this district Butte Highlands Mining Co., of Spokane, has taken an option and lease on the Leadhill property, which, with the LaSota group, gives the company 30 claims. Butte Highlands has suspended operations on its gold property near Butte, Mont.

▶ Northwest Mining Association, of Spokane, forwarded recently to Washington, D. C., a report that it was almost impossible for mining companies to comply with the regulation that trucks hauling out ore shall return with 75 percent tonnage loads. Senator Murray, of Montana, took up the matter with the defense transportation office at Washington and secured an agreement that the mining industry would be exempt.

▶ Victory Copper Co. has traced its copper showings for about half a mile at its property 18 miles north of Newport, Pend Oreille County. A shaft has been sunk 80 ft. to a point where the ore was found to be 3 ft. wide. A tunnel is being driven to cut the vein at the 400-ft. level, where it is expected the ore will have a greater width.

▶ The width of the vein being worked at the Knob Hill property, at Republic, is said to be 18 to 35 ft., carrying ore some of which runs $15 to $18 in gold. About 250 tons are milled daily. F. H. Mitchell is manager.

▶ The Aluminum Co. of America reduction plant near Spokane already has two units in operation and when completed will have six units producing. The aluminum rolling mills will be completed in January or February.



Carl and Robert Olson have constructed this equipment, which they declare is saving the flour gold in the Snake River which has defied miners for more than 60 years. The location is on the south side of the river, five miles below Clarkston, Wash. Lewiston Hill, 2,000 ft. in elevation, is shown in the background. The operators and their associates call themselves the Little Million Syndicate

CALIFORNIA

Green Mountain Copper Co. Now Producing

Idaho Maryland options mercury property—Quartz crystal deposit to be worked—New chromite developments

▶ Volo Mining Co., which holds a contract with Metals Reserve Corp. for 10,000 tons, either of concentrates or ores, containing the required chrome content, is now operating the remodeled 200-ton mill available at the company's Shaw property, near Placerville, El Dorado County. Ore currently produced at the plant is trucked in from Latrobe and other county points, and with chrome mining increasing steadily in the area, milling operations are expected to expand accordingly. About 15 men are employed, under the direction of F. V. Phillips, president and general manager.

▶ Idaho Maryland Mines Corp. is reported to have taken an option on the Midway quicksilver mine, near San Jose, Santa Clara County, with examination work being carried out by several members of the company's engineering staff. Errol MacBoyle is executive vice president of the corporation.

▶ Production of quartz crystals is scheduled to commence soon at the Jack McSorley property two miles west of Mokelumne Hill, Calaveras County. The mine was worked last in 1924, with the Navy Department acquiring the entire output. A new road has been constructed recently from the main highway to the mine, and equipment is being assembled as a preliminary to developing the crystal-bearing gravel beds.

▶ Production of copper ore carrying good values has been started from properties near Mariposa, Mariposa County, operated by the Green Mountain Copper Co., C. C. Kellogg, general manager. As a new producer, the company is being paid the bonus stipulated by the government, which brings the price received for the copper up to 17c. per pound.

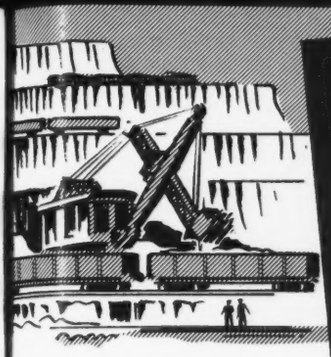
▶ New development work has been started at the Cloverdale quicksilver mine, on Sulphur Creek about 12 miles east of Cloverdale, Sonoma County, by Red Pine Mining Co., the operating unit of B. C. Austin Co., Inc., of San Francisco, following acquisition of the property from Western Mercury Co., San Francisco, and a lease held by J. Garcia, who has operated the property for about a year, producing some 25 flasks of quicksilver per month. A rotary-furnace installation and several retorts are available. W. N. Hubbard, superintendent, is in charge of operations.

▶ Operations have been suspended at the Omega hydraulic gold mine because of shortage of water. During the season just ended about 40 men were employed at the property under the direction of Theodore A. Larsen, superintendent.

▶ Lord & Bishop, dragline dredge operators with offices in Sacramento, have taken an option on the Fanning chrome mine, in the Forest Hill area of Placer County, which was a producer of chromite during the First World War.

▶ Metals Reserve Co. has established another purchasing depot at Anderson, Shasta County, where small lots of chromite and manganese ore are received.

▶ Carrol Winrod, of Downieville, Sierra County, is developing a chromite deposit on Mt. Holley, with output being stockpiled pending shipment to the Metals Reserve Co. purchasing depot.



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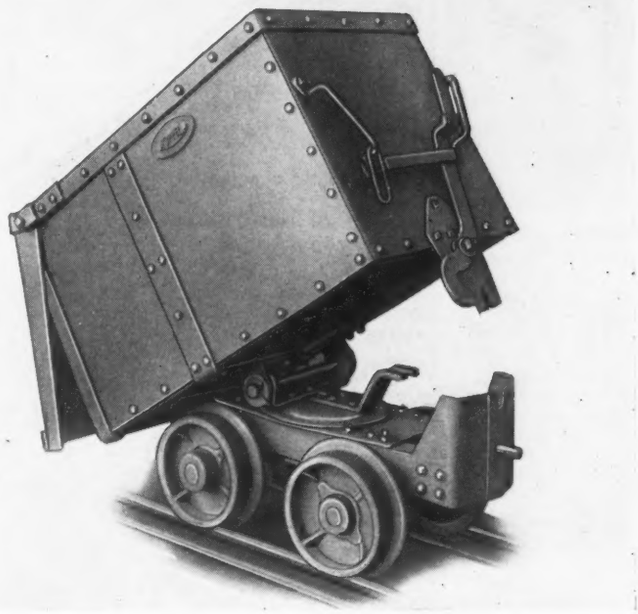

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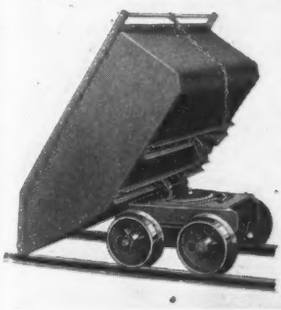
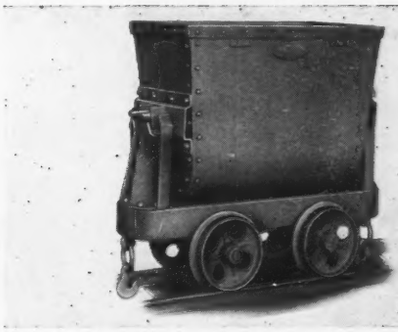
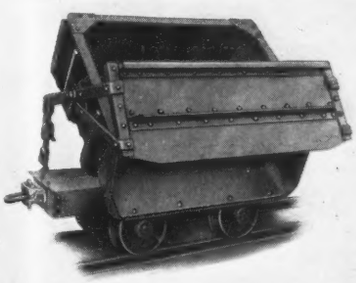


ALL-AROUND OR END-DUMP TYPE CAR *with scoop shaped body. Hand controlled lock, conveniently placed, releases simple latch arrangement for dumping. Sizes 12, 18 and 27 cubic feet.*

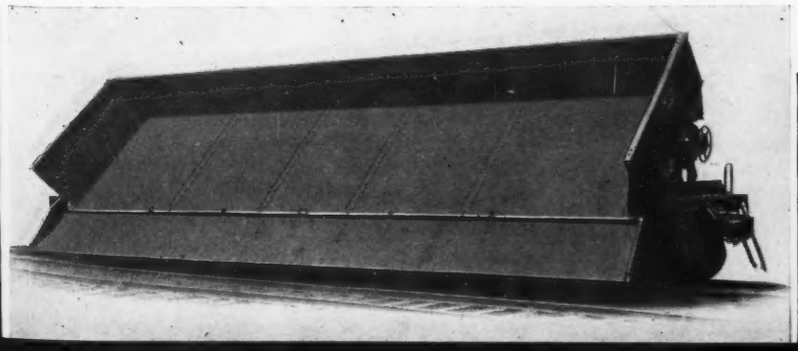


DOUBLE SIDE DUMP TRUNNION TYPE CAR, *designed in narrow widths for close clearances for underground operations. Trunnion supports exceptionally well braced to withstand end thrust. Steep dumping angle insures free discharge of load.*



GRANBY TYPE CAR, *heavily reinforced for extremely severe service. Rounded body corners, steep dumping angle. Furnished with either safety link-and-pin or automatic type couplers.*

TRAY TYPE CAR *furnished in capacities from 3 to 12 cubic yards, heavily reinforced. While this car is intended primarily for rock quarry service, it has been found adaptable to certain metal mining operations.*



AUTOMATIC AIR DUMP CAR (*50 cubic yard car illustrated*). *Built in cubical capacities from 12 to 50 yards, and load carrying capacities up to 90 tons. Provide rapid discharge of load, free from excessive shock to car or track. Conveniently located air dump handle permits dumping to either side. May be dumped singly or in trains controlled from any car or from locomotive.*

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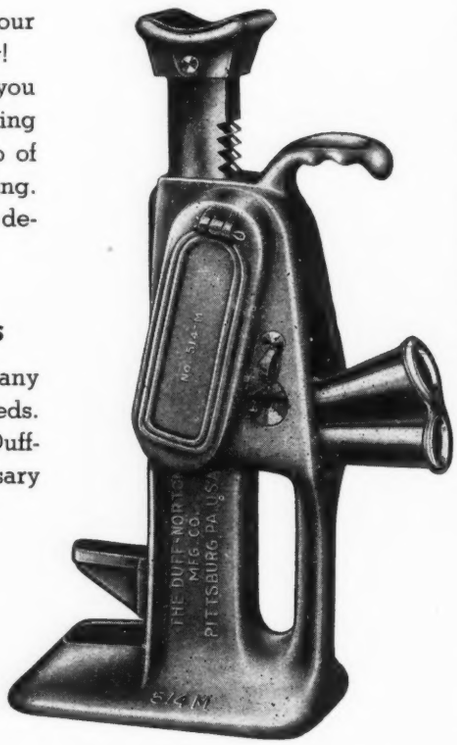

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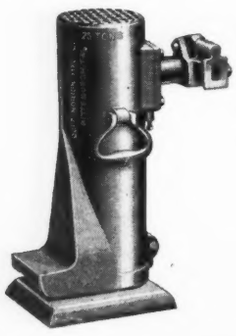

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ALASKA

Investigate Chromite in Chugach Mountains

Viebe gold dredge destroyed by fire—Fairbanks gold operations short of miners—Nickel-copper prospect on Baranof Island

▶ The Territorial Department of Mines has examined chromite occurrences in the Chugach Mountains, near Anchorage, but has not yet made a report. John E. Ryan says the chrome ore outcrops in Pioneer Gulch, one-half mile from the Palmer highway. It was discovered several years ago by Gaylord K. Skinner, and four claims were located on the ledge. Samples submitted to the department are said to carry a chrome-iron ratio of 2.8 to 1. The chromite occurs as black, submetallic, disseminated specks in dark green dunite, weathered to a creamy buff on exposed surfaces. Other occurrences of chromite are found in nearby gulches.

▶ Howard Sparks, in two months of the early spring, accumulated considerable antimony at a property on Broad Pass. He has several sacks of the ore and expects soon to have a carload. Eskil Anderson, of the Territorial Department of Mines, will check the quality and quantity of the ore. Some work was done on the property during the last war.

▶ Drilling and refinery crews have entered the MacKenzie River district at Fort Norman to reopen the Northwest Company's oil well and refinery, and pipe is being sent in for a pipeline from that district to Fairbanks and the Yukon River.

▶ N. R. Hudson, who has come out from Fairbanks, reports that not only has the large new dredge on Livengood Creek closed but that many of the smaller operations are working short-handed due to the scarcity of miners. Some are running with half crews or less. Mr. Hudson and Jay Livengood discovered the Livengood placers in 1914.

▶ There still is considerable mining in the Klondike. Ed Holbrook has been made dredgemaster for the Sixtymile dredge, which he has raised and put into operation again. It sank recently. Joe Britton says he expects the Yankee Girl Mining Co., of California, will take over his ground at Kirkman, where he has been mining all winter.

▶ John C. Reed and George O. Gates, of the U. S. Geological Survey, have examined a nickel-copper deposit on Snipe Bay, Baranof Island. The district is about 20 miles northwest of Cape Ommaney and about 46 miles in an airline southeast of Sitka. The deposit is a dark, coarse-grained mass of basic igneous rock intruded into older quartzite and quartz schist. It is estimated the deposit does not exceed 0.3 percent of nickel and the same amount of copper, and is probably too low in grade to be worked profitably at present prices. It is hoped, however, that further prospecting, surface stripping, and the drilling of a few holes may prove the deposit to be sufficiently large and rich to warrant mining.

▶ A mysterious explosion, probably from an accumulation of fuel gases, caused a fire on June 3 which destroyed the N. J. Viebe dredge, on Yankee Creek, in the Ophir-Iditarod district, according to a delayed mail report. John Moklebust, dredge engineer, was severely burned and rushed by plane to Fairbanks, where he was given three blood transfusions. The dredge was in operation at the time the fire occurred and had aboard it considerable equipment, which was destroyed.

MONTANA

Sunshine Now Producing at Prospect Creek

Silver Crescent completes cyanide mill—Hydraulic gem mining ruled seasonal—Silver Star now shipping chromite ore

▶ American Gem Mines, of Philipsburg, has received a ruling that hydraulic mining of sapphires in Montana is a seasonal industry within the meaning of the fair labor standards act. Montana sapphire miners employing hydraulic mining methods may work 12 hours a day or 56 hours a week during a 14-week period each year without payment of overtime. This ruling does not apply to dredging operations recovering sapphires.

▶ George Mayer, of Basin, is experimenting with the recovery of "stream tin" from the placer gravels in his property on Basin Creek. The gravel he is sluicing primarily for the placer gold content contains a small percentage of cassiterite, which is caught in the "black-sand" concentrate in sluice boxes. Mayer has recovered and sold a ton or more of cassiterite pebbles in the process of panning the concentrate for recovery of the gold. Cassiterite of sand grain size constitutes a considerable proportion of the "black sand" concentrate, and by some refinement of his recovery methods Mayer hopes to recover this in addition to the coarser cassiterite pebbles occurring in the sands.

▶ Vernon J. Davis, of the Silver Star Chrome Co., has announced that development work and near-surface mining are in progress on the Silver Star chromite deposits near Silver Star on the edge of Jefferson River Valley. A new truck road to the mine has recently been completed. Crude chromite ore is being mined selectively and shipped to the Metals Reserve Co. stockpile in Butte. If subsequent exploration develops enough milling grade ore, a concentrator may be considered. Silver Star Chrome is a new mining company, recently organized to exploit these deposits. Chromite mining is a new industry for the Silver Star district. Mining there has heretofore been confined to sporadic production from several small gold mines. The chromite deposits are not a new discovery. Lenticular bodies of chromite in a gneiss and schist complex were discovered many years ago, but little attention was paid to them prior to the outbreak of the present war.

▶ Fred Masolo and Guy Osello are working their lease on the Fredonia claim west of Butte, producing manganese ore. An old 60-ft. shaft in the vein has been cleaned out and retimbered. A new compressor house has been built and a small air compressor and mine hoist have been installed. Manganese dioxide ore is mined from the shaft and from trenches in the vein outcrop. A carload of ore now on the dump is to be shipped to the Metals Reserve Co. stockpile in Butte. Masolo and Osello are among the first of the small-scale leasing operators in the Butte district to get into production in the present war. During World War I a number of these operations flourished on the outlying manganese veins in the Butte district.

▶ Sunshine Mining Co., operator of the well-known Sunshine silver mine, at Big Creek, Idaho, is now producing antimony ore in Montana. Sunshine has recently acquired the Barto and Snyder groups of 13 patented and 22 unpatented mining claims in the Prospect Creek district, out of Thompson Falls, Sanders County, Mont. Ore from the Snyder group of claims is being trucked to a stockpile at Big Creek, Idaho, where the Sunshine Mining Co. is building an antimony plant. The Prospect Creek mining operations are conducted through adit tunnels. Gasoline-driven equipment now in use is to be replaced by diesel-engine power, as electric power is not available. Mark Evans is foreman of the operation. Until acquired by Sunshine the Prospect Creek antimony deposits had been prospected sporadically for several years with indifferent success. Two or three carloads of ore were shipped in the past. Lack of a suitable market for the ore retarded development of the district.

▶ Silver Crescent, Inc., operating in the Marysville district, has completed a new 100-ton cyanide mill and new assaying office. The mill will treat gold ore from the company's Bald Mountain and Belmont mining properties. Development work is in progress in the mines. Ore is being blocked out and sampled. The Bald Mountain and Belmont mines have a production record extending back to the early days of gold mining in Montana. The present operation is a new one in the district. Guy E. Riegel is president and general manager, Clyde B. White is mining engineer, and Percy Rogers is mill superintendent.

▶ G. E. Vandercook of Milwaukee, Wis., has a small crew of miners exploring the Trapper Creek manganese property, in Beaverhead County. Equipment consists of a portable air compressor and pneumatic rock drills. An adit cross-cut to the ore horizon has been completed and drifting is in progress. In 1918 100 tons of battery-grade manganese dioxide ore was shipped from the property.

▶ Ermont Mines, west of Dillon, in Beaverhead County, is shipping 100 tons of gold-silver ore daily to its cyanide mill. The company has produced steadily from the Ermont mine for seven years. The operating shaft is now 500 ft. deep. R. B. Caswell, of Portland, Oregon, is president; P. A. Sheridan, general superintendent, and B. W. Burke, mill superintendent. Between 50 and 60 men are employed in the operation.

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IRON COUNTRY

Oliver Producing From Gross-Marble Mine

Evergreen building washing plant at Grand Rapids—Republic will strip Columbia orebody—New shaft on Gogebic Range

▶ The Gross-Marble mine of the Oliver Iron Mining Co. entered the list of active mines of the Mesabi Range this past month. This ore is all beneficiated at the Trout Lake concentrating plant at Coleraine, Minn. The Prindle mine at Virginia will be ready for production in September. Work is being rushed on the concentrating plant and also in the pit. The Mountain Iron mine, at Mountain Iron, Minn., is now being dewatered, and it is expected that the mine will be ready for shipments by the opening of navigation in 1943. It is estimated that 1,500,000,000 gallons will have to be removed before any substantial work can be done in the pit to get it in condition for production. Two pumps are now working 168 hours per week pumping 7,500 g.p.m. A crushing and screening plant will also be constructed to serve this mine.

▶ The Evergreen Mines Co., Crosby, Minn., is now erecting a washing plant at the Greenway mine, Grand Rapids. Hugh H. Harrison is superintendent, with headquarters at Hibbing, Minn.

▶ Cleveland-Cliffs Iron Co. is salvaging iron ore from dumps of old mining operations in the city of Ishpeming. Fifty years ago, considerable ore, now reclaimable, was dumped in open pits. Recovery is now being made with dragline and bucket, the ore being hand-picked after being brought to the surface. It is anticipated that from 25,000 to 30,000 tons of ore will be reclaimed in this way. This development is an outgrowth of a successful reclaiming project carried out by Cleveland-Cliffs at Champion, where several thousand tons of ore were recovered and shipped.

▶ Stripping operations have been started preparatory to opening a new mine at the Columbia orebody of the Republic Steel Corp. on the Menominee Range. This orebody is between the Tobin mine of the same company and the Monongahela mine of the M. A. Hanna Co. Republic has arranged to use the Monongahela shaft to hoist the Columbia ore.

▶ Pickands, Mather & Co. is preparing to core-drill a new shaft adjacent to the Cary mine, in Hurley, on the Gogebic Range. It is reported that the shaft will be 3,000 ft. deep and will be used to carry on mining operations below the 2,700 level in the Cary mine. Ore will be hoisted to the 2,700 level and then hauled to the Cary shaft for hoisting to the surface.

▶ It is reported that efforts are being made to settle the collar-to-collar cases now pending for Michigan iron mines, as it is felt that to continue the disputes will reflect upon the capacity of the mines to contribute maximum production to the war effort.

▶ Iron ore shipments for the month of June amounted to 12,625,102 tons. This was about 50,000 tons less than was shipped in May, but the daily average for June is higher. The total for the year to date, July 1, was 33,952,166 tons, an increase of 18 percent over the shipments to that date in 1941. At present there are 300 American boats and 29 Canadian boats in the ore-carrying trade. One new boat has already entered the active list, the "Leon Fraser," of the Pittsburgh Steamship Co. fleet. This boat arrived in Duluth on her maiden voyage June 23. This is the first of five new boats that are to be commissioned this year.

IDAHO

Sunshine Antimony Plant Nearing Completion

Bonanza will double mercury capacity—Manganese mining begins in State—Federal reopening Frisco mine

▶ Construction of a large antimony recovery plant is rapidly nearing completion at the property of Sunshine Mining Co. in Big Creek near Kellogg. It is the outgrowth of nearly 1½ years of experimental work carried on in a pilot plant currently producing cathode antimony. Treatment involves leaching the tetrahedrite concentrates produced in the mill and containing from 20 to 22 percent antimony in hot concentrated alkaline solution, electrolyzing pregnant solution in diaphragm cells, and regenerating the alkaline sulphide content of the barren solution prior to its return to the leaching circuit. Sixty percent of the output will be obtained from tetrahedrite concentrates and 40 percent from stibnite ore mined at the company's property on Stibnite Hill, in the Prospect Creek district between Burke, Idaho, and Thompson Falls, Mont. The section handling stibnite ore is scheduled to start operations during August and the tetrahedrite unit during September. Resultant copper-silver residues will be shipped to the Tacoma smelter for reduction. R. D. Leisk is general manager and Church Holmes is in charge of the concentrator and antimony recovery plant.

▶ Bonanza Mines, a new quicksilver development in the Yellow Pine district of Idaho, is planning to double its present furnace capacity by the addition of a 100-ton unit. Production now is about four flasks of quicksilver daily. Tom A. Monahan, of Yellow Pine, is mine superintendent and H. C. Wilmot, of Sutherlin, Ore., is consulting engineer. The property is in the famous "primitive area" of Idaho, into which the government is now building a highway to service the deposits of tungsten and antimony ores recently found there. The discoveries of antimony, tungsten, and quicksilver have all been made by diamond drill work sponsored by the U. S. Bureau of Mines and the U. S. Geological Survey. The orebodies were found at comparatively shallow depth. It is understood that the Bradley Mining Co. had to sink a shaft only 150 ft. to start production of tungsten ore.

▶ Bunker Hill & Sullivan M. & C. Co., at Kellogg, will have one of the most modern concentrating mills in the Western mining states when its present remodeling operations are completed in its North mill. All construction will be of steel and concrete. Normal capacity of the plant is said to be rated at 1,500 tons daily, but it will handle a peak load of 1,800 tons if necessary. All construction, replacements, and remodeling are being done without disturbing the daily production of the old system. The new plant is being constructed in six separate units of 250 or 300 tons each. There will be no pumping of materials back and forth. The entire flowsheet is on a gravity basis. Each unit consists of an 8-ft. ball mill which feeds by gravity to a 4-ft. flotation machine, which separates the lead and zinc minerals, and from there to filter machines which handle the output of all the units. The units are six in number and are arranged in a row, each independent of the other and each operated by separate electric motors. The entire battery of ball mills is fed by an H & H sink-and-float unit which handles all the feed from the mine and discharges the waste material, thus providing a richer mill feed than was formerly possible.

▶ Sidney Mining Co., of Kellogg, is making arrangements to finance its property for a resumption of productive operations, which, it is said, will soon be started. The company's property, in the Pine Creek district, is connected with the Bunker Hill smelter and Sullivan zinc plant by an aërial tramway and storage bin, the latter being in Government Gulch near the zinc plant. The mine has produced a large tonnage of lead-zinc ore and with a few repairs is said to be in condition to resume large tonnage production. It is reported that William Beaudry, well-known mining man, former general manager of the Golconda and other properties in the district, will become the manager at the Sidney.

▶ W. W. Staley, professor of mining at the University of Idaho School of Mines, Moscow, will make a reconnaissance mineral survey of the Cassia County region and conduct a school for prospectors. Professor Staley is being sent by the Idaho Bureau of Mines and Geology, of which Dr. A. W. Fahrenwald is director. Purpose of the survey and school is to hasten the production of strategic metals and minerals in this region.

▶ Stressing the importance of the tungsten orebodies recently opened in Idaho's Yellow Pine district in Valley County, the U. S. Bureau of Mines announces that these deposits, although still in the prospect stage, are now producing one-fourth of the tungsten being used in the war program.

▶ Federal Mining & Smelting Co. has ten men employed unwatering the old working of the Frisco mine, in the Coeur d' Alenes, preparatory to a resumption of operations. The mine formerly was one of the major producers on Canyon Creek, but was closed down when the lower working developed an excess of zinc ore for which there was no market at that time. It is understood the ore will be milled at the Morning mine plant at Mullan.

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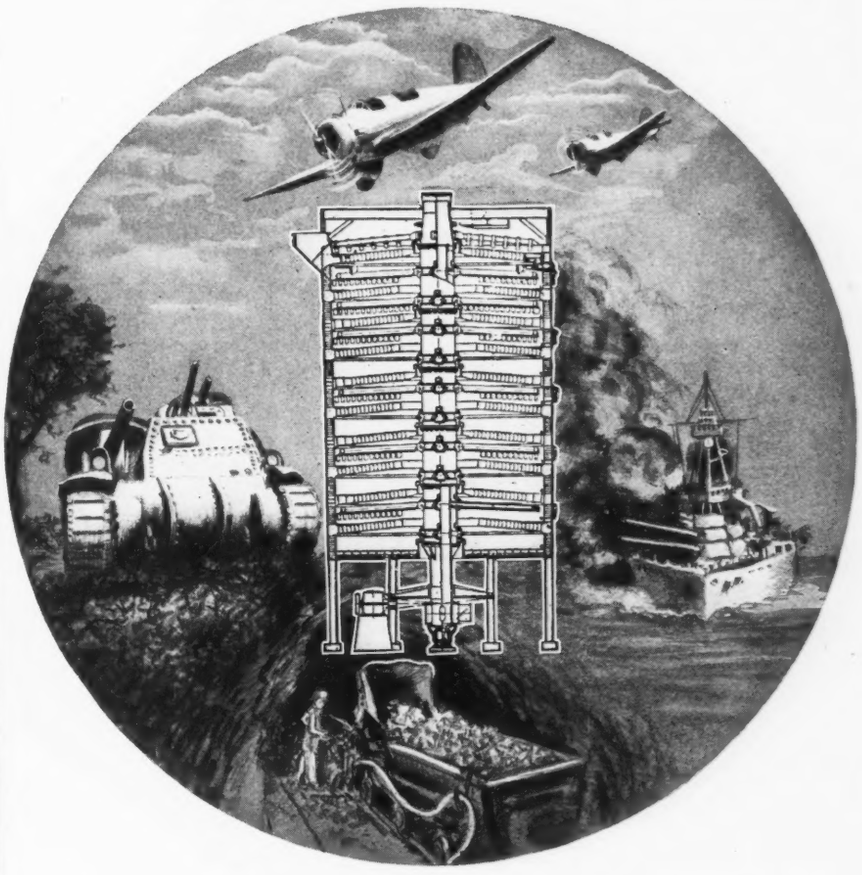

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▶IDAHO

▶ A 30-ton flotation mill and new mining equipment has recently been installed at the Pope-Shenon copper mine, at Salmon, Idaho, by Lawrence J. Bills, who has organized the Lemhi Copper Co. to handle the Pope-Shenon and other properties in the Salmon territory.

▶ A new manganese mining property is being opened in Bannock County under a contract for 10,000 tons of ore to be purchased by the Metals Reserve Corp. The Loose Mining Co. has been organized to handle the mining with Preston G. Peterson as general manager. This is believed to be the first attempt at commercial production of manganese in Idaho.

▶ The Clayton Silver Mines has been shipping zinc concentrates from its new zinc unit for the past two months. Assays show a zinc content of 54.5 percent. The company is operating under a quota of 91 tons of lead and zero on zinc. Two company trucks are engaged in transporting the ore to Mackay, a distance of 65 miles. Costs of the truck hauling are $1.25 a ton less than the old contract price of $3.50 a ton and an additional charge of $2 a ton for back-haul.

▶ The Gibbonsville Milling Co., headed by Walter C. Clark, of Kellogg, has completed its new slime tailing concentrator, now in operation on Brown Flats, below Kellogg, treating the slimes that have accumulated on the flats from the Bunker Hill and other mining operations. The plant is a modern 200-ton capacity mill equipped to make a separation of the fine lead and zinc settled in the tailings. It is estimated several million tons of slimes are available. Feed is delivered to the mill by pumping operations. The Gibbonsville company was formerly engaged in a gold mining enterprise at "Gibtown," Idaho, one of the pioneer gold camps in the Salmon River area.

▶ Dewey Daily and Roy Roberts are operating the Texido gold property, near Idaho City, and are milling their ore production in the Mellor-Proffer mill, on Wiflow Creek.

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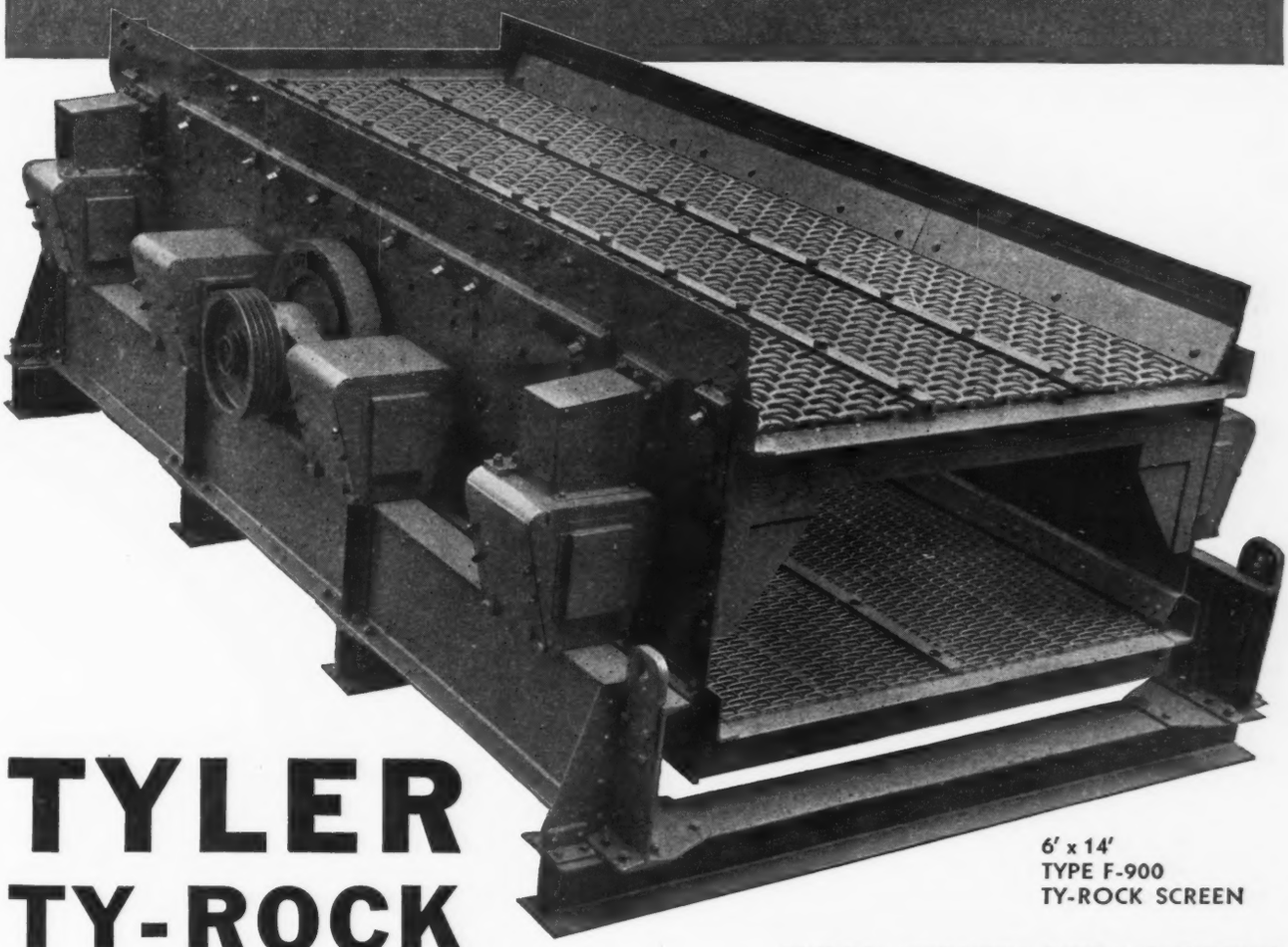

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▶IDAHO

▶A 30-ton flotation mill and new mining equipment has recently been installed at the Pope-Shenon copper mine, at Salmon, Idaho, by Lawrence J. Bills, who has organized the Lemhi Copper Co. to handle the Pope-Shenon and other properties in the Salmon territory.

▶A new manganese mining property is being opened in Bannock County under a contract for 10,000 tons of ore to be purchased by the Metals Reserve Corp. The Loose Mining Co. has been organized to handle the mining with Preston G. Peterson as general manager. This is believed to be the first attempt at commercial production of manganese in Idaho.

▶The Clayton Silver Mines has been shipping zinc concentrates from its new zinc unit for the past two months. Assays show a zinc content of 54.5 percent. The company is operating under a quota of 91 tons of lead and zero on zinc. Two company trucks are engaged in transporting the ore to Mackay, a distance of 65 miles. Costs of the truck hauling are $1.25 a ton less than the old contract price of $3.50 a ton and an additional charge of $2 a ton for back-haul.

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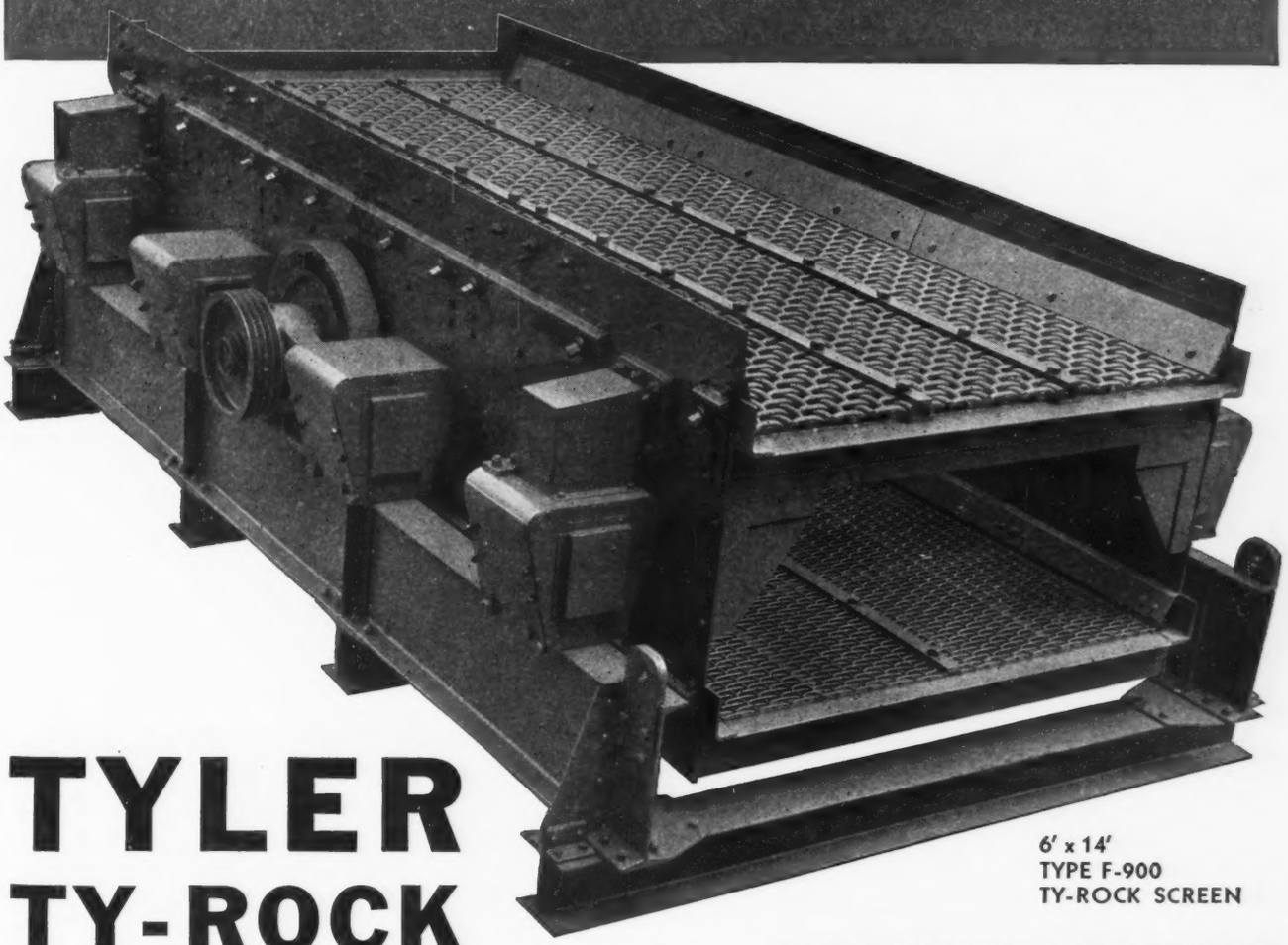

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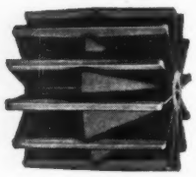

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TAIL PULLEY SAVES

ELEVATOR AND CONVEYOR BELTS

"Beltsaver" is as far ahead of the open face pulley as a B-19 Bomber is ahead of the "flying piano boxes" of World War I. "Beltsaver" is especially recommended for use as an elevator boot pulley on conveyor tail pulley when handling sand, gravel, stone, ore, ashes, coal and similar sharp, abrasive materials. Users report belt life increases of from 50% to 100% over that which they obtained when using a solid face pulley. "Beltsavers" are made in standard sizes and are interchangeable with solid face pulleys.

COMPARE:

Ordinary Type Solid Face Pulley

. . . in the under side of the solid face pulley causing extensive damage.

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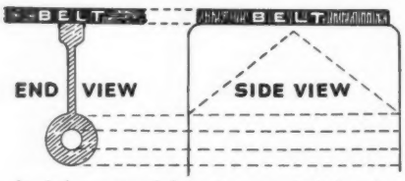
Wing Type Tail Pulley

ONLY 20% OF PULLEY PERIMETER TOUCHES BELT

Note the cross sectional end and side elevators. End view of rounded wing (Left Below) shows contact with belt. Face surface of these wings is wide enough to pull without harm to belt, and because they represent less than 20% of the total pulley perimeter, "Beltsaver" offers less than 1/5 the wearing surface of an ordinary solid face pulley. Note the exclusive wing and cone design of "Beltsaver" provides runways which allow material to escape—thus preventing



its being pressed into the unprotected under side of the belt—causing abrasion and serrations.

"BELTSAVERS" are made in standard sizes and are interchangeable with regular face pulleys. Send for data sheet with complete diameters, sizes, faces, and prices.

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▶TRI-STATE

▶ M. & M. Mining Co. has moved a steel derrick and 500-ton hopper from a shaft on the Buffalo lease to a shaft on the Piokee lease, northwest of Picher. A 400-ton hopper of wooden construction, similar to one constructed by the company on the Goodwin lease, has been built in conjunction with the steel structure for the separate storage of ore from two leases being mined by the company —the Piokee and the White. Ore for the wooden hopper is conveyed by belt from the steel derrick hoist dump; that for the steel hopper is dumped directly into this hopper. A railroad spur has been extended to the two hoppers from the main line of the N. E. O. Railroad in the northwest part of Picher. Ore is hauled to the Eagle-Picher Central mill for treatment.

▶ Mission Mining & Royalty Co. has reopened the old Aztec mill shaft, a half-mile south of Hockerville, according to Jack Howard, of Miami, company superintendent. Ore is being treated over the Mission mill, a mile north of Quapaw.

ARKANSAS

Low-Grade Bauxite to be Mined

Manganese production increasing—American Zinc opens manganese drilling campaign—New zinc mill at Jasper

▶ A large tonnage of bauxite that had been thought to be too low in grade to mine is being considered now as a necessity by WPB. The ore is in Saline and Pulaski counties, Ark., and will be utilized for purposes other than aluminum manufacture, such as refractories, chemicals, and abrasives. All bauxite with 15 percent or less silica content will be allocated to the war industries. Many abandoned mines will be reopened to produce this low-grade bauxite, which is a welcome addition to our bauxite reserves.

▶ The American Zinc Co. of Arkansas, of which Robert Ammon, is general manager, has opened two ore markets in the Batesville-Cushman manganese field. One is at Pffeifer, in the east part of the field, and the other at Cushman. Purchases of soft black, or wad, ore, are now running approximately 100 tons a day, and the stockpiles in the ore yards are building up rapidly. Concerning other operations of his company in the field, Mr. Ammon said: "We have started a drilling campaign in the field and will use 15 churn-drill rigs in the operations. The drilling will be done on the Denison and Gibbons properties. Several methods of treatment for soft black, or wad, ore are being considered. Construction on a beneficiation plant for this ore will start when authorized by Metals Reserve Co."

▶ J. J. Inman, of Joplin, Mo., formerly Tri-State manager for the American Zinc, Lead & Smelting Co., took over as resident manager of the American Zinc Co. of Arkansas, at Batesville, early in June.

▶ Sims Bros., operating the Kelley mine, near Pfeiffer, are making a good production. They produce three grades of ore: high-grade oxide, wad, and what is classed as nugget.

▶ Increased production in the field in June was caused by excellent mining weather conditions, two local markets for low grade, and increased operations. The Aydelotte property, two miles east of Cushman, is the largest producer of wad ore in the field at this time. Mining is from shafts and drifts, the ore being encountered at from 50 to 90 ft. Besides its underground operations the company also operates a big washer.

▶ Preston Grace and Fred Livingston, of Batesville, Ark., who hold a big acreage in the field, have increased their operations in the Lafferty Creek district and now have several shafts down into high-grade oxide.

▶ The Hoxsey-Rogers Co. is operating seven properties and making a big production of all classes of ore running from low-grade wad to high-grade oxide. The company also operates three washers.

▶ Miners working on the Club House mine, near Cushman, one of the many properties owned by the Walter H. Dension Manganese & Contracting Co., have just completed a new shaft 130 ft. deep, which is one of the deepest in the field. Some good runs of high-grade oxide were found in the shaft and a good production is being made.

▶ The Bruce Williams Laboratory, of Joplin, Mo., has established a branch office at Batesville, Ark., to do the assaying for the field. This is a great convenience to the operators.

▶ The Newton County Mining Company, of which Charles Herman, of Chicago, Ill., is secretary, and W. T. Wells, of Jasper, Ark., is president, has started the construction of a new 100-ton mill near Jasper, which will be used as a central milling plant for a number of mines they are operating in the area. They expect to have the new plant in operation in 90 days. They now hold leases on the Kilgore, Hudson, and Sloan mines, and on 320 acres on Buffalo River, near the Big Jumbo. When the mill is placed in operation it will produce both jack and carbonate concentrates.

▶ Moark Mining Co., operating the Gloria, Jack Pot, Red Mill, and Minnie Lee mines, at Zinc, Ark., in Boone County, has completed a small temporary mill, which it put in operation about June 10. The company will operate this plant until it finds equipment for a modern 100-ton mill. Both jack and silicate of zinc ores are produced.

▶ The Joplin Mining Co., which holds a lease on the Beatty mine, on Jimmy's Creek, near Yellville, Ark., is at work drilling out the property with churn drills.

▶ Cleve Byrd and associates, who hold leases on the Baker and Brewer mines, at Ponca City, Ark., in Newton County, have started to sink a deep shaft and also an incline. The ore here runs in a fissure vein and they expect to sink to the bottom of it.

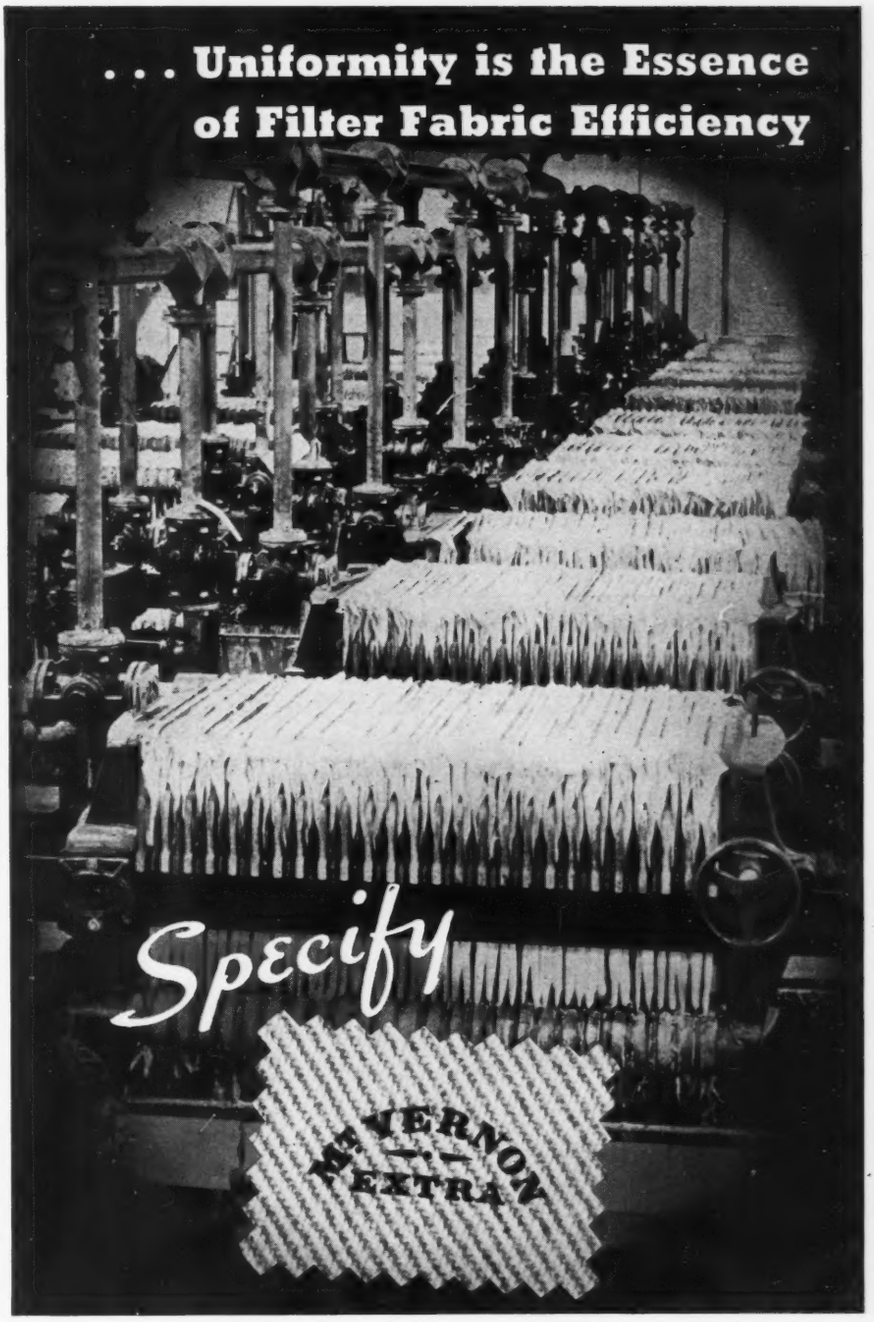
MICHIGAN

Quincy Will Re-Treat Torch Lake Tailings

Exploratory work at Arcadian mine—C & H reopening part of Central property—Exploration for graphite undertaken

▶ Contracts have been signed which make possible the erection of a plant for the re-treatment of the Quincy Mining Co.'s tailing deposit at Mason, on Torch Lake. The contracts call for payment by the Metals Reserve Co. to Quincy of a loan of $1,150,000, to be expended in the construction of this plant. The loan is to be retired by payment of 4c. per pound of copper produced. Calumet & Hecla will construct the plant and will let the contracts subject to the approval of Quincy and the Metals Reserve companies. Two main structures will be moved from Calumet & Hecla property, being no longer required by that company. The buildings will be dismantled, transported, and re-erected by a large Midwestern construction company. Much of the machinery will be furnished second-hand by Calumet & Hecla, particularly motors and grinding units. The arrangement seemed particularly attractive to the government because much of the equipment required was on hand, thus conserving critical raw materials. There will be three important operating units, comprising a dredge, a shore plant classifying house, and a fine-grinding and flotation unit. Regrinding and classifying units will be connected by a belt conveyor gallery. The conveyor gallery will be 260 ft. long and the regrinding and flotation building will be 125 ft. wide and 250 ft. long. All concentration will be by tabling and flotation. The dredge machinery is being designed by the Bucyrus-Erie Company of South Milwaukee. The hull of the dredge will be of wood, so as to conserve steel plate, and will be built either locally or in Duluth. It is planned to treat only the richer part of the Quincy bank, chiefly tailings that were deposited before 1902. All copper produced is to be sold to the Metals Reserve Co. for 17c. per pound. The plant is to treat 4,000 tons of stamp sand daily and it is hoped to have it in operation early next summer. From 50 to 60 men will be employed. After its completion, the plant will be operated by the Quincy Mining Co.

▶ Faith in modern scientific methods of searching for copper is soon going to meet the acid test at the old Arcadian mine, as a tunnel being driven by a small crew nears the shafts abandoned since 1905. Favorable indications, discovered when a magnetic survey of the region was made between 1926 and 1933 by field parties of the Michigan Conservation Department's Geology Division, are being tested by the present work. Prof. W. A. Seaman, of the Michigan College of Mining and Technology, for several years chief of field parties, is now technical adviser to the new company, the Arcadian Mines, Inc., organized in May. An adit is being driven into Quincy hill and is now more than



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Shafthouse and part of the mining plant of Canadian Refractories, Ltd. The three-compartment vertical shaft was deepened to 553 ft. in 1940. The ore is mined by shrinkage stoping on four levels, at 110, 250, 400, and 540 ft., respectively

▶MICHIGAN

3,000 feet long, with crosscuts. The adit will intersect the old shafts between the sixth and seventh levels. The shafts will be unwatered in this way. This is believed to be the only adit type mine in Michigan.

▶In line with the policy of the Calumet & Hecla Consolidated Copper Co. to increase production to the fullest extent, plans have been perfected to reopen the Central fissure property exploratory shaft, located near the old Central mine location in Keweenaw County. This shaft was sunk 200 ft. in 1935. At that time some cross-cutting and drifting were done, following a fairly well-defined fissure. Although operations as planned may not result in important copper production, underground exploratory information of considerable value may be gained. About 30 men will be employed.

▶A brief reconnaissance of the region south of L'Anse, in Baraga County, for indications of graphite deposits is being made by Dr. Justin Zinn, of Michigan State College, at the direction of the Michigan Conservation Department's Geological Survey. The national need for knowledge of more graphite reserves prompted the survey's temporary transfer of Dr. Zinn from the copper deposit exploration near Mass City in Ontonagon County. Crucible graphite is a critically short commodity, and special steps have been necessary to conserve supplies.

▶The Calumet & Hecla Consolidated Copper Co., will place a diamond drill at work on the fifth level, at a depth of about 250 ft., in the Ropes gold property, north of Ishpeming, which it controls through a lease from the Republic Steel Corp. The company will employ one of its own drilling machines and use its own employees for the operation.

CANADA

Bateman Takes Control of Mine Output Rate

New mine operations given tax relief—Tyranite, Spud Valley, and Central Zeballos shutting down—Selective Service limits B.C. and Yukon gold-mine labor

▶In order to prevent aggravation of the critical shortage of materials and labor, the Metals Controller issued an order early in July that forbids any Canadian mine to expand production above the average monthly tonnage of the first four months of 1942 unless a special permit is granted. Permission must also be secured to operate any property that was not in production on June 15. An exception is provided in the case of Kirkland Lake mines, which are to be credited with normal tonnage treated in the months before the strike. Base-metal miners in British Columbia are allowed a six-month deferment of conscription. In line with the satisfactory working of local priority committees in the mining camps, it is now proposed to pool stocks of machine parts and supplies on hand at individual mines for distribution on an industry-wide basis.

▶An Order-in-Council, retroactive to June 15, provides for shipment of Canadian electrolytic zinc to the United States without duty or taxes, and for importing Prime Western zinc on the same basis. The United States is short of the high-grade product of Flin Flon and Trail refineries, and a less pure zinc is required in some Canadian industry. The new regulation provides for shipments across the border without tariff restrictions.

▶ The new budget favors new base-metal producers by the same method as that applied to gold mines several years ago, as proposed by the Minister of Mines, the Hon. T. A. Crerar. New base-metal operators are exempt from all taxes except the 18 percent corporation income tax, the benefit applying to any mine coming into production after next January. The established producers, such as Waite Amulet, must pay an excess profits tax of 100 percent, the larger portion of the levy to be refunded after the war. Due to contracts with Great Britain, few base-metal mines in Canada are earning excess profits, and Normetal and International Nickel have agreements allowing tax preferences to pay for mine expansion that is now in progress.

▶ Dr. R. C. Wallace, principal of Queen's University, gave evidence before a committee of the House of Commons on the difficult situation forecast for the mining industry at the end of the war. "In the last two years . . . of the gold mines, by the end of the year, 56 will have gone out of business, representing a loss of 12,625 tons, and the total tonnage in gold mining is about 60,000 tons." A warning was given that no new money is going into the business, prospectors are no longer active, and no discoveries are being made. To revive mining, it was proposed to bonus new operations and to alter the tax policy so as to spread the revenue over a longer period of time. "One of the best things that could happen in Canada would be a large base-metal industry in iron and smelting, and if it is possible to develop the Steep Rock iron properties which are under negotiation west of Port Arthur and carry the ore down the lakes to lower Quebec we could use some of the Labrador ores as well and the power that is so abundant in Quebec, and we could find a market for a considerable part of the coal in Nova Scotia."

ONTARIO

▶ Chesterville Larder Lake Gold Mining Co. has been blocked by wartime restrictions in its plans to increase mill capacity from 750 to 1,250 tons a day in an effort to reduce operating costs. The last report on ore reserves showed 737,000 tons averaging $5.39 a ton, with a large additional block of ore indicated by drill holes. Higher values have been showing up below the fifth level, where three new levels are being developed. At the lowest horizon there is an increase of $2.30 a ton and widths have increased up to 40 ft. L. T. Postle is mine manager.

▶ Robert R. Brown, president of Upper Canada Mines, reports that adequate equipment and supplies are on hand and advance development has been completed to allow operations to continue under war restrictions. The general manager, R. J. Hendry, states that the tonnage of probable ore is being maintained. The No. 1 shaft has been deepened to 1,250 ft., where a new level is being opened. The No. 2 shaft, 2,900 ft. west, is down to 375 ft. and the bottom level has been extended to connect with the No. 1 shaft.

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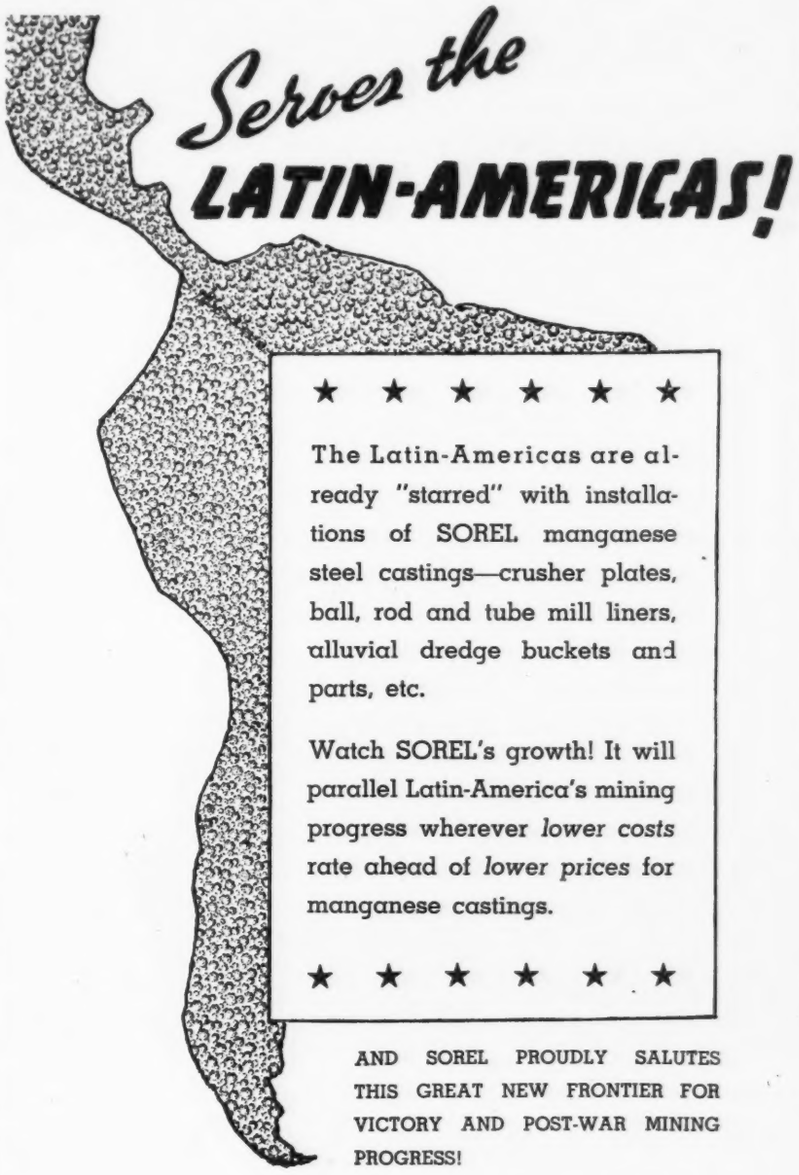

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▶CANADA

▶ Eldon L. Brown, vice president of Sachigo River Exploration Co., told shareholders that almost $85,000 had been received on the sale of the mining and milling equipment, allowing a distribution of $5.25 a share when the company is wound up. Taxes of $20,000 have been paid and an Ottawa decision is being awaited to show whether a larger levy will be made. The mine is the farthest north in Ontario and had overcome heavy handicaps in transportation, largely due to the ability of the mine manager, B. G. Edwards. The mill operated from May, 1938, to January, 1942, when the high-grade orebody was exhausted.

▶ Jack E. Hammell, president of Hasaga Gold Mines, reports that he has been reimbursed all loans that were made to put the mine in production and that profits are now going into the treasury. A new orebody has been indicated between the 500- and 650-ft. horizons to the west of the main mine workings, and a program of exploration at depth has been started.

▶ Tyranite Mines, a subsidiary of Sylvanite, has reached a decision to shut down for the duration. In an isolated location in the old Gowganda silver camp, a labor shortage has added to the troubles of declining ore reserves. The managing director, Welles V. Moot, reports that excellent ore indications have been secured from diamond drilling below the bottom 1,125-ft. level, but shaft sinking another 450 ft. cannot be undertaken under present conditions.

QUEBEC

▶ Low-grade chrome deposits at Black Lake are being investigated by engineers for the War Metals Corp. with a view to their development into a source of concentrates for the manufacture of ferrochrome. The deposits are reported to contain a substantial tonnage of ores of approximately 10 percent grade. If development proves feasible, it is anticipated that a 600-ton daily rate of production will be established. These deposits were worked during the first World War. Much of the equipment will come from the Howey gold property, which was closed down several months ago.

▶ J. G. Pierdon, manager of Lapa Cadillac Gold Mines, reports that mill heads of around $7.75 a ton in June led to total recovery of $36,000 for the month, which allowed for profits well above normal. Operating under more favorable conditions than other mines in the Cadillac camp (except the O'Brien), the Lapa shows prospects of continuing active for some time. A length of 115 ft. of new ore has been opened in a new oreshoot on the bottom 690-ft. level. Discovered in May by diamond drilling, the ore is still open at the east end, with values above mine average. All production is now coming from the new north zone, where values are considerably better than in the original south zone.

Production began in May from the 700-ft. shaft and 300-ton cyanide mill of West Malartic Mines, Ltd., at Malartic, Quebec

▶ Aldermac Copper Corp., the property of which is 10 miles west of Noranda, continues to produce 400 tons a day of pyrite concentrates from 1,000 tons of low-grade copper ore treated in the mill. The winter rate of 12,000 tons monthly of pyrite shipments has been increased to about 16,000 tons, including concentrates from the large stockpile. Ore reserves are good for another 16 months' operations, with no prospects for opening additional ore when that is gone. Efforts are being made to find a new property. George D. McLeod is the mine superintendent and A. V. Corlett is mine manager.

▶ During the first week of July, Noranda Mines tested out its elaborate new ventilating system. First used in Canada four years ago, the process was developed in England for use on the Rand. A 96-in. propeller forces 250,000 cu.ft. of air per minute through the downcast duct, leading to the 6,000-ft. level. Access for air to the 3,500-ft. horizon is provided by the No. 6 shaft. The upcast course from the various levels is through the No. 5 shaft at the west side of the mine.

▶ Normetal Mining Corp., operating about 100 miles northwest of Noranda, has been finding difficulty in maintaining a working force but has been able to keep the mill running at capacity. In the past two years the daily rate has been doubled to about 800 tons. Four new levels are being opened up below 2,000 ft., with an improvement in the copper content. J. A. Little is mine manager.

▶ According to reports from Havre-St. Pierre, considerable prospecting is being done in the Romaine River valley. The geological party of the Quebec Bureau of Mines, headed by Dr. J. A. Retty, whose report covering last year's work led to the present activity, is also at work in the area this season. It is said that many claims have been staked in the Lake Allard and Lake Petit Pas areas, where last year's work uncovered evidence pointing to possible commercial deposits of ilmenite. A number of new discoveries in the Romaine River Valley are reported.

BRITISH COLUMBIA

▶ The Director of National Selective Service (Ottawa) has issued an order which prohibits British Columbia and Yukon gold-mining operations from employing any new labor until such time as ample mining crews have been provided for base- and strategic-metal operations. This action has been taken, no doubt, on account of the fall in production at some of the essential base-metal mines as a result of an alarming shortage of labor. Another order from the same source grants exemption from military service to employees of base-metal operations, and it is understood that similar treatment is to be accorded to coal miners, also much in demand. Early opposition to the order from the gold operators has given way to more rational consideration, and the Mining Association of British Columbia, which embraces all major mining operations within the Province, has sent a delegation, comprising A. S. Baillie, general manager of the Granby Consolidated Mining, Smelting & Power Co., Ltd., and V. J. Creeden, secretary-treasurer of the Hedley Mascot Gold Mines, Ltd., to Ottawa to make constructive recommendations in this connection to both the Metals Controller and the Director of National Selective Service of the Commonwealth.

▶ Dividend disbursements by British Columbia mining companies during 1941, at $16,599,402, established a new annual record, exceeding 1940 payments by more than two million dollars and the previous peak-year of 1937 by over one and one-half millions. The Britannia and Consolidated M. & S. companies recorded substantial increases in distribution, but the general trend was downward in the gold mining operations.

▶ The Hon. Herbert Anscomb, Minister of Mines, has announced that the B. C. Department of Mines will intensify the search for stannite and cassiterite as a result of the successful recovery of tin from the waste product of the Sullivan concentrator.

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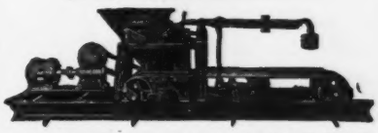

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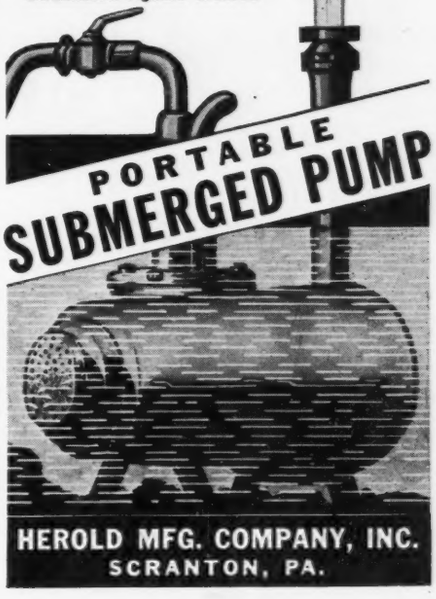

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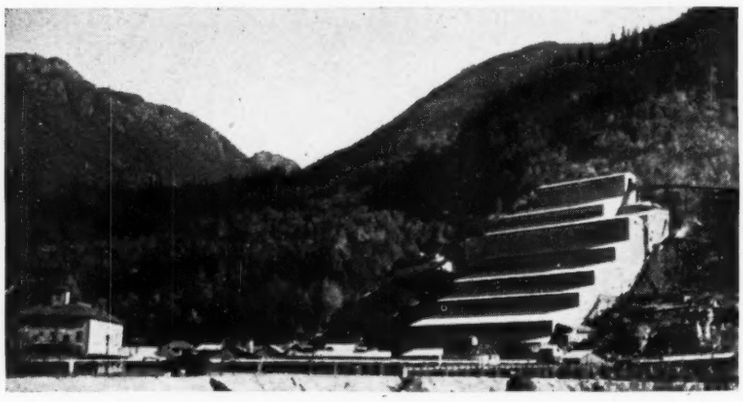

One of Canada's important suppliers of copper concentrates is the mill of the Howe Sound Company, British Columbia, Canada

▶ CANADA

▶ During the fiscal year ended May 31, 1942, Sheep Creek Gold Mines, Ltd., foremost Nelson district producer, recovered bullion valued at $1,009,429. Net profit, after provision for all taxes and write-offs, was $378,298, equivalent to slightly more than 20c. per share. A dividend of 4c. per share, plus a special bonus of 1c. per share, was paid on July 15. June production was valued at $69,369, from 4,651 tons, averaging $14.30 per ton.

▶ Kelowna Exploration Co., Ltd., privately owned Osoyoos district operation, produced 33,881 oz. gold, valued at $1,304,418, from 97,476 tons, averaging 0.347 oz. gold per ton, in the year ended Dec. 31, 1941. Development work included 4,718 ft. of drifting, crosscutting, and shaft-sinking; and 12,156 ft. of diamond drilling. A major development program, now in progress, is the sinking of the Morning incline shaft for 1,000 ft. at an angle of 50 deg. Dividend disbursements were increased from $270,000 in 1940 to $300,000 in 1941.

▶ The Consolidated Mining & Smelting Co. of Canada, Ltd., has transferred 18,000 ft. of tramline from a discontinued silica-mining operation near Ymir, in the Nelson district, to the Red Rose tungsten property, in the Omineca mining division of northern British Columbia.

▶ All buildings and wharves have been destroyed by fire at Anyox. An option on the former copper-smelting plant and property had recently been taken by Ventures, Ltd., which had intended to establish a steel industry at that point. Anyox is on Observatory Inlet in the Portland Canal district.

▶ Spud Valley Gold Mines, Ltd., largest employer of labor in the Zeballos district, closed operations at the end of June. A marked shortage of labor, difficulty in securing priorities, and a trend towards a lower grade of ore, were the reasons given by directors for the course taken. May production, the last for which figures have been released, was valued at $31,546 from 3,681 tons averaging $8.62 per ton.

▶ Central Zeballos Gold Mines, Ltd., partly owned Reno subsidiary, has closed milling operations as a result of its inability to maintain a competent operating crew. During the latter part of 1941 and the early part of 1942 a long, low-level crosscut was driven to connect the presently productive sections of the mine directly with the mill. An underground crew is being retained to complete connection of this crosscut with the higher horizons. This development is expected to reduce materially the cost of operation, and it is possible that milling may be resumed at an early date. Production during recent months has been reasonably consistent, with values of $26,833 in March, $24,836 in April, and $28,728 in May.

▶ Privateer Mine, Ltd., leading Zeballos gold producer, has developed a new vein in the Prident mine which D. S. Tait, president, states has proved to be one of the best orebodies found to date, averaging 3.55 oz. gold per ton over an average width of 0.49 ft. for a continuous length of 330 ft. The lead is now being sought on other levels. The Privateer operation has benefited to some extent by the closing of other mines in the vicinity and was recently able to secure 30 additional men. June production was 2,086 oz. gold, valued at $80,316, from 2,523 tons, averaging 0.827 oz. gold per ton.

YUKON TERRITORY

▶ Officials of The Yukon Consolidated Gold Corp., Ltd., largest Canadian placer operator, have denied rumors that the company would close operations at the close of the current season. G. R. F. Troop, secretary-treasurer, states that the company has ample supplies and that if the labor situation becomes too acute, the management will merely reduce its scale of operations.

▶ Bralorne Mines, Ltd., has announced that its wholly owned subsidiary, Canbrae Exploration Co., Ltd., has discontinued work and dropped its option on the placer tungsten property on Canadian Creek, formerly operated by Canadian Tungsten, Ltd. The Bralorne company states that the results of the exploratory drilling program were disappointing.

MEXICO

Transportation Bottlenecks War Mineral Production

New zinc-lead operations at Taxco—La Minera resuming operations—Zinc producers protest federal tax

▶ Need for adequate transportation facilities for mining has become more apparent. The industry is handicapped by inadequate railroad service, particularly from the government's National Railways, Mexico's largest rail system. The railroads are suffering from an acute shortage of rolling stock, mostly in their freight division. Petitions are pouring in upon the government to give special attention to transportation in mining areas.

▶ The government has just settled an old dispute that hampered work of the miners who for some time have been working cooperative mines that Peñoles turned over to them in the Ojuela region, Durango. This conflict resulted from the intrusion of prospectors on the properties. The prospectors maintained they had as much right to work the tracts as the cooperatives. The government induced the cooperatives to accept the 200 prospectors as their members, in installments of 75 per month.

▶ The federal labor boards have 519 claims for indemnification filed with them by miners who say they were incapacitated by tuberculosis contracted while in service.

▶ Juan Manuel Elizondo has been officially declared secretary general of the national miners' union, which claims a membership of 80,000. The union announced the ending of dissension resulting from the move of some leaders and some sections to line the union up with the National Proletarian Association, a radical group.

▶ Official investigation is being made of the fire, of obvious incendiary origin, that has disrupted mining operations at Canoas, Zacatecas. The blaze destroyed more than 100 buildings and was said to have resulted from friction between the regular miners and prospectors who sought to edge in on the mining properties. There are reports that the fire was engineered by Axis agents.

▶ Protests against the recent federal tax of 12 pesos ($2.25) per ton on zinc production have been made to the Ministry of Finance by various mining interests, principally small scale operators, who contend that the tax leaves them so little money that there is no inducement to continue working. These operators are preparing a petition to President Camacho if the ministry does not give them relief.

▶ Several important mining belts in Chihuahua and Sonora will be benefited by the highway the federal government is building to connect these states. Work on this road is progressing so favorably that it is expected to be in service about the end of this year.

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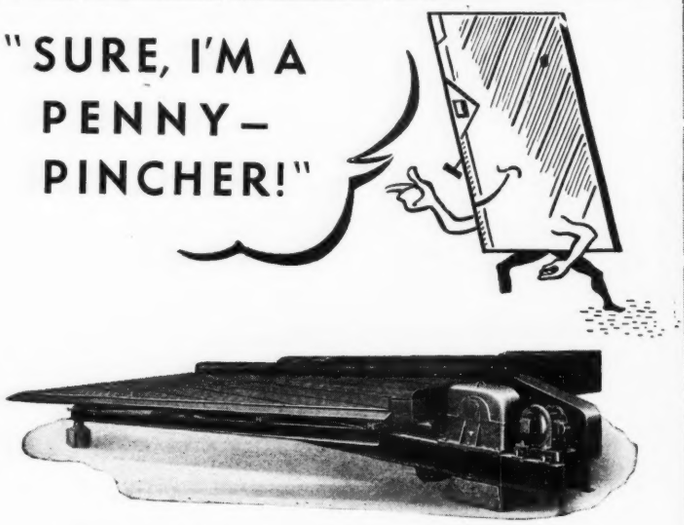

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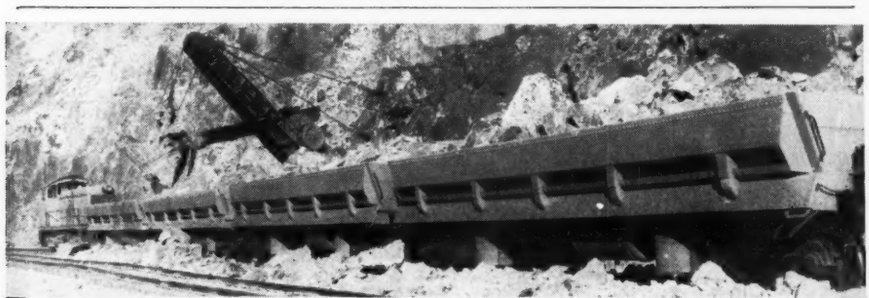

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▶MEXICO

▶The Supreme Court allowed the Cia. de Combustibles Agujita, S. A., a coal mining company of Sabinas, Coahuila, an injunction restraining the Ministry of Finance from collecting sales taxes on electricity it obtains in conjunction with Cia. Carbonifera de Sabinas, another coal company of the zone. The court upheld Agujita's contention that procurement of this electricity is not selling or buying. This ruling affects many mining operations throughout Mexico.

▶Eagle-Picher (Compania de Minar, S.A.) and A.S.&R. are opening several new operations at Taxco, Guerrero, to develop and mine zinc-lead ores carrying gold and silver values.

▶The county court at Piños, Zacatecas, is called unfair in a complaint by the national miners union to Gen. Panfilo Natera, the Zacatecas Governor, because it permitted Cia. Beneficiadora Zacatecana, S. A., to retain 14 containers of cyanide for its operations after the union had obtained a lien on all the company's properties in connection with wage claims by its employees.

▶The machinery department of Cia. Minera Real del Monte y Pachuca, Hidalgo, was considerably damaged when a railroad car that some company workers were operating jumped the track in the yard. Two men were killed and one man was injured.

▶Arrangements are being completed by Cia. Minera La Minerva, S. A., Asientos, Aguascalientes, to resume work after a long suspension. Prospects of good and steady markets for its products as a result of the war prompted the company to arrange for resumption.

▶The Labor Ministry is conducting negotiations intended to settle a dispute involving Cia. Minera Providencia, S. A., Concepcion del Oro, Zacatecas, resulting from a labor demand for a fifteen percent wage increase, which the company asserts it cannot afford.

▶Mexican coal is to be used exclusively for at least the duration by Cia. Minera de El Boleo, S. A., a French-owned copper mining company, Santa Rosalia, Baja California. Auguste Nopper, general manager, as it has become next to impossible to obtain this fuel from the United States, the former supply source. The domestic coal is being obtained from a new mine in the Tonichi district, Sonora, which is served by a recently completed spur of the Southern Pacific Railway of Mexico. The fuel will be shipped from Guaymas, the principal Sonora port, across the Gulf of California to Santa Rosalia.

▶Labor conditions are far from smooth in the Cananea copper belt, Sonora. The federal government is seeking to correct a situation arising from the alleged refusal of union leaders to allow the employment of non-union men, despite the recent agreement between the national miners' union and the companies of that zone permitting employment of free miners.

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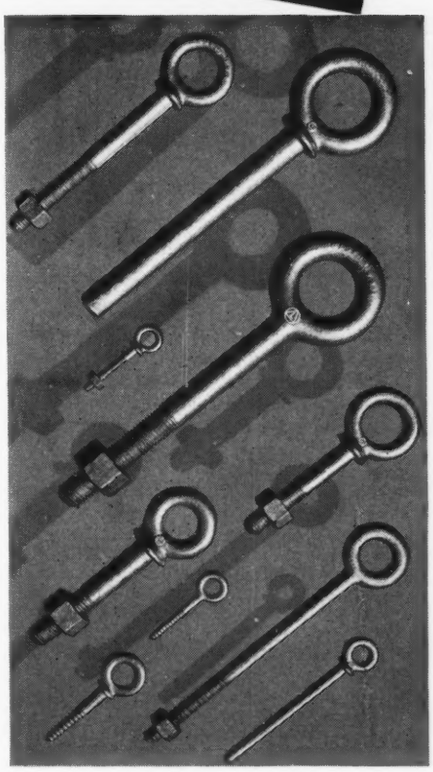

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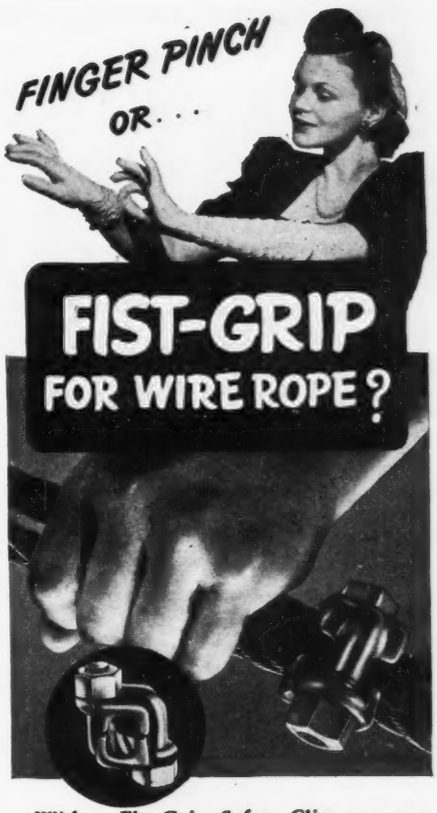
Libanon suspends development work—Diamond supply deemed adequate—Gold Coast Main Reef is promising

▶ Not the least sign of nervousness or of jitters in British mining circles is to be discerned. Except in those mines in countries which are in control of the enemies, mining activities are proceeding as usual and the tendency is rather for production to increase than decrease. Where there are slight decreases they are due to delay in receiving supplies, or to the loss of considerable numbers of the working forces to armies, navy, and air personnel. In South Africa, for instance, many technicians and miners have joined the services and 1,000 more, chiefly technicians, are being released by the mining companies. In addition, South Africa has undertaken the production of greatly increased amounts of strategic minerals and is largely expanding its output of iron and steel. Despite all this, the output of gold is being well maintained and is close to the high record of all time. The high output is made possible by the curtailment of development work in many mines where ore reserves are already many years ahead, and by reduced activities in the exploitation of new properties.

▶ The Transvaal output of gold in May was 1,214,897 oz., or 32,309 oz. more than in April. It was only 4,081 oz. less than in May a year ago. The largest output on record was 1,235,784 oz. in October last year. Working profits for May are estimated by the Transvaal Chamber of Mines as £3,734,707, which is £87,995 more than in the one-day shorter month of April. The number of natives employed by all the mines decreased by 3,035 at the end April. At that time the total number was 367,997. This was 7,926 fewer than the high peak reached at the end of February. Dividends paid by the Witwatersrand mines from the earnings of the first half of this year came to £8,598,000, which is about £1,000,000 less than last year at the same time and is £1,150,300 less than was paid in December last. The decreases in dividends are accounted for almost wholly by taxation increases. How burdensome taxation has become is deducible from the figures given above. Only £8,598,000 was available for dividends for the first half of this year out of working profits which must have exceeded £22,000,000. It may be added that the shareholders receiving those dividends also pay heavy income taxes on them.

▶ Libanon Gold Mining Co. has suspended all development and construction work, presumably for the duration of the war. This far western Witwatersrand company has been developing a mine in an area which adjoins the new producer, Venterspost, and, like the latter, is a subsidiary of West Witwatersrand Areas. It is said to have developed approximately sufficient ore to justify beginning work on the erection of a plant. Official



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▶AFRICA

estimate is that when conditions warrant a resumption of operations only two years will be required to bring the mine to production. This will necessitate the completion of No. 2 shaft and the continuation of development work while a reduction plant is being erected. Libanon has an issued capital of £2,465,000, and at the end of June, 1941, had a cash balance of £426,000 for development purposes. The decision of the management to suspend operations was probably influenced chiefly by the difficult supplies and capital situation. Work on the property has been going forward steadily since it began in September, 1936, and developments so far have been in payable reef.

▶ Sir Ernest Oppenheimer, chairman of De Beers Consolidated Mines and the dominant personality in many other diamond-producing companies, has been interviewed in Johannesburg by Reuter's correspondent regarding the reported shortage of industrial diamonds. He declares that there is no shortage at present or in prospect. Substantial stocks are available from which all requirements can be supplied. A slight rise in price would bring tremendously increased quantities of a slightly better quality of diamonds to market, and this increase would not be great enough to cause any appreciable advance in general production costs. He further mentioned that Société Minière du Beceka has a large accumulation of industrial diamonds in the Belgian Congo and that its production could be greatly increased at short notice.

▶ Selection Trust, Ltd., the parent company of the several mining enterprises developed and directed by A. Chester Beatty, reports a final net profit of £197,989, an increase of £23,969 over that of the preceding year. Taxation, after crediting £21,900 overpaid in previous years, took £44,500, against £63,000. In view of having received no dividends from Trepca Mines—whose properties in Yugoslavia are temporarily in the hands of the German invaders—and reduced dividends on its large holdings of American Metal, the results are considered particularly satisfactory. Selection Trust's dividend is maintained at 7½ percent and £40,000 is set aside as an exploration reserve. The report states that the company is maintaining its participation with Union Corporation, Ltd., and Western Holdings, Ltd., in the exploration and development of large areas in the Orange Free State and is also interested in areas adjoining the property of Western Reefs Exploration & Development Co., Ltd. It adds that work in these areas has been temporarily suspended owing to war conditions. Selection Trust is in a strong financial position.

▶ Ariston Gold Mines crushed 46,060 tons more ore in 1941 than in 1940, as a result of its plant and mining expansion, and realized £48,487 more for gold sold. Nevertheless it earned £44,639 less than the year before. Largely owing to the increase in the cost of materials and labor, the report says, the cost of mining rose by £95,857, to £352,768. Presumably

this bulk increase includes the cost of mining and handling the extra 46,060 tons of ore. But the over-all expense increased 3s. and 7d. per ton despite the much larger tonnage handled, to 24s. 6d. per ton. Ore reserves were increased by 508,385 tons last year and now amount to 2,227,888 tons averaging 7.17 dwt. per ton. The grade is 0.55 dwt. per ton lower than a year ago by reason of the greater portion of the new ore being developed in the lower grade No. 2 orebody.

▶ Col. Frank Johnson, chairman of Kwahu Mining, declared at the recent meeting that Gold Coast Main Reef, in which Kwahu is largely interested, gave promise of developing into a really big gold mine. Gold Coast Main Reef's annual report is now out and seems to provide the reason for Col. Johnson's confidence. The company began producing in November, 1939. Its profit for the past year was £155,816, after writing off £21,403 of development expenditure and charging £26,328 to depreciation. It paid an initial dividend of 7½ percent. Ore reserves were increased 35,101 tons to 526,301 tons averaging 10.2 dwt. per ton. Operating costs were reduced 4s. 10d. to 31s. 10d. per ton.

AUSTRALIA

Tax Policies Cramp Mine Development

Paringa has good outlook—Lake Campion clays may yield potash—Zircon Rutile doubles capacity—Oil shales being developed in Queensland

▶ Although base-metal production is the foundation of defense, the consideration given to this industry by those responsible for taxation does not imply recognition of that fact. The country is being urged to expand exploration for, and output of, all base metals required for munition purposes. A special government committee, known as the Minerals Production Committee, has been formed and is developing into a large organization with powers and finance to assist and encourage production by existing producers, or to reopen such abandoned mines as may appear to possess satisfactory prospects of renewed output. This effort is expected to yield results, but the operations of the committee are seriously handicapped and production is restricted by the inequitable impositions of the taxation department. The weight of protest has at last had some effect on authority, but the result is quite inadequate to give the essential relief and encouragement to the industry. A concession of 20 percent. of income is now to be allowed before the imposition of taxes. When it is considered that many mines do not remain in operation for a much longer period than five years, and that many more close down before attaining even that brief life, the effect of the provision in insuring merely a return of capital is evident.

▶ There has been considerable, and increasing, uncertainty as to the future of

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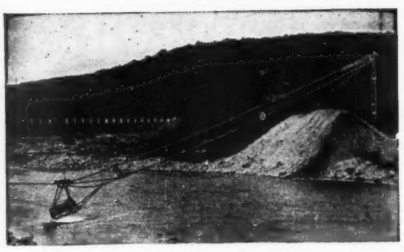

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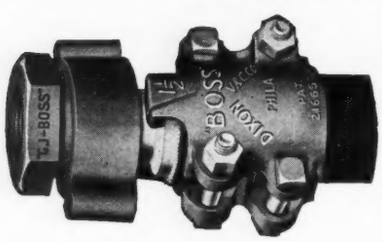

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▶AUSTRALIA

gold mining in the Australian states. It has been proposed to utilize a large part of the labor now employed in gold mines for works of a military nature, such as the construction of roads and airdromes. The problem is not simple, for such a course would have a serious effect on Western Australia, far more so than on any other State, for gold mining is its most important industry and the basis of its financial stability. Western Australia is naturally offering strong opposition to the proposal, which has been put forward with apparently little regard for the ultimate consequences to the industry and to the State which it maintains; for, apart from the drastic financial consequences, much of the State would be depopulated. In Victoria vigorous opposition has been put up by the State government, and the outcome is still in doubt. Meanwhile, the drift of labor to the fighting forces and to munitions industries is having a serious effect, and definite action is imperative if the safety of many mines is to be assured and their asset value to the nation preserved for future years.

WESTERN AUSTRALIA

▶A striking degree of success is attending the operations of Paringa Mining & Exploration Co., Ltd., which commenced work on its present leases toward the northern end of the Boulder belt, at Kalgoorlie, in 1934. Ore reserves now stand at 368,761 long tons after eliminating all ore under a grade of 4 dwt. gold per ton, which is equivalent to four years' supply to the mill. During the last financial year 93,655 long tons of ore having an average grade of 5.26 dwt. per ton was treated. Combined mining and milling costs, exclusive of development redemption, were 31s. 3d. (Aust.), compared with 27s. 5d. (Aust.) in the preceding year. Underground work on the "Greenhill" shoot reached a depth of 800 ft., which is the lowest level yet reached in the mine. The company is also exploring the Croesus South and Block 45 mines, and results are satisfactory. It has also purchased mining areas totaling 55 acres adjoining the south side of the Mount Charlotte leases and has taken options over an additional 86 acres at the northern end of the goldfield.

▶Lake Campion, 233 miles north of Perth, has been examined as a possible source of potash for Australian requirements. The lake deposit is alunitic clay, with an average depth of 14 ft. An area of 400 acres, which has been closely prospected, is estimated to contain 16,000,000 tons of alunite with a potash content worth approximately £A.32,000,000. The syndicate which has carried out the initial exploratory and testing operations is now unable to proceed further, and the State government has taken over the area. It is proposed to spend £A.75,000 on preliminary development. Earlier reports stated that the test work being conducted into the treatment of the material had been successful in establishing a process suitable

to this particular occurrence. The deposit is favorably situated for economical working, being within 4 miles of a railway and with 3 miles of a branch line from the Goldfields water supply.

▶ At the annual meeting of the Wiluna Gold Corporation, Ltd., in London, the chairman, Sir Frederic Hamilton, stated that ore reserves at March 31, 1941, were 1,115,000 tons, having an average value of 3.5 dwt. gold per ton. This total was 71,000 tons less, and the grade 0.3 dwt. lower, than in previous estimates. Below the 1,800-ft. level the grade of ore decreases to 2.95 dwt. per ton. The future of the mine depends on developments in depth. The ore is refractory and the successful working of a grade under 3 dwt. per ton demands most efficient management and administration, which the mine possesses, and that operations must continue smoothly on a large scale. Since the close of the financial year, throughput has increased slightly and recovery has improved by 3 percent. These favorable factors have, however, been offset by a reduction in the grade of ore and a rise of approximately 9d. per ton in working costs, which have reduced the working surplus, and in existing circumstances lower working costs cannot be anticipated. The lowest level of the mine is now at a vertical depth of 2,200 ft. from surface.

▶ For some time, driving on the bottom, or No. 31, level of the Sons of Gwalia mine, at Leonora, 150 miles north of Kalgoorlie, has disclosed low values. The March report, however, showed a material change for the better, which is satisfactory as an indication of downward persistence of payable gold in this important mine, which has reached a depth of nearly 5,000 ft. on the underlay from surface. The report covering a period of eight weeks to March 24 shows that a total of 19,938 tons of ore was treated in the period for a recovery of 5,642 oz. of gold. Working costs were £A.30,034, and development expenditure amounted to £A.4,420.

VICTORIA

▶ The Bendigo field has been less attractive during the opening months of the year, due to the fall in grade of ore in some of the larger producers and unsatisfactory results in several of the prospecting companies. A number of companies which had commenced work in the latter part of last year were compelled to cease work owing to lack of labor before the situation became acute. The field still has an attractive future. Ample support to the industry is given by Victoria Gold Dredging Co., N.L., at Newstead, where about 50,000 cu.yd. per week of ground having an average value of 3.5 grams gold per cubic yard is being treated, and by the Wattle Gully Gold Mines, N.L., at Chewton, and the Morning Star (G.M.A.) Gold Mines, N.L., at Wood's Point. At the Watt'e Gully mine output has been reduced consequent upon the labor position, but the grade of ore milled has been increased from 7 dwt. to over 8 dwt. per ton. The Morning Star mine maintains a grade of about 12½ dwt. per ton and

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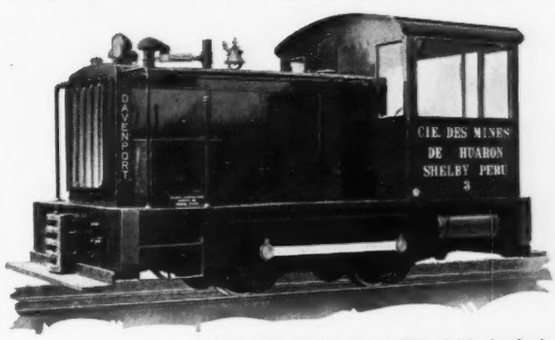

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▶AUSTRALIA

has substantial tonnages of ore in sight. Another important and consistent producer is the Maude and Yellow Girl Gold Mining Co., N.L., at Glen Wills, which is working a considerably faulted lode containing a marked proportion of pyrite. The company produces gold bullion and concentrates to a value between £A.3,000 and £A.4,000 per month.

▶At the Morning Star (G.M.A.) Mines, N.L., at Wood's Point, in the mountain regions of the State, the company has been carrying out extensive prospecting by diamond drilling which will ultimately be carried to approximately 2,000 ft. below the bottom, or No. 16, level. The reefs, or, as they are locally termed, "floors," consist of quartz and altered diorite intersecting a wide diorite dike. Their length approaches 1,600 ft., with a maximum width of about 300 ft. They strike north and south and the dip is east or west at an angle which seldom exceeds 25 deg. Their thickness varies from a few inches to at times as much as 10 ft., the mean width being about 4 ft.

NEW SOUTH WALES

▶Zircon Rutile, Ltd., is a consistent and successful producer of zircon and rutile-ilmenite concentrate from an extensive deposit of beach sand on the north coast of the State. For several years the company has produced sufficient concentrate to meet local requirements and to maintain an export trade, but recent demands, both for Australian use and for American requirements, have increased to such an extent that it has been necessary to duplicate the plant. Concentrating tables are used to eliminate silica from the sand as mined, after which concentration is effected by flotation and gravity methods. Zircon concentrate and a rutile-ilmenite concentrate are marketed. The sand contains zircon as the principal economic mineral constituent, with rutile, ilmenite, cassiterite, and monazite in order of relative proportion. The two last-named minerals are not recovered.

QUEENSLAND

▶Queensland's active interest in the utilization of oil-shale deposits is centered in the Alpha shale occurrence. A fair amount of exploratory work has been carried out and the extent of the beds reasonably well established. Test work on samples of shale have shown an oil content up to 150 gal. per ton. The deposits have been taken over by an industrial group in Brisbane which intends to erect a small plant in the preliminary stages of its operations to produce enough oil for its own requirements. Any surplus output will be sold to outside consumers. There are several similar deposits of large extent in the State, and success in this venture should have an important influence on the exploitation of this source of oil.

Reflections From Washington

(*Continued from page* 74)

Confusion Over Rubber

THE RUBBER SITUATION was further confused in the public mind by nation-wide publicity attendant upon a display in Washington by the Rubber Manufacturers Association, tending to inspire the belief that, with proper administration, civilians need not be denied rubber tires. Commenting upon this exhibit, Arthur B. Newhall, WPB Rubber Coordinator, stated:

"The nub of the situation, as I see it, is this—*if* we can spare the reclaimed rubber, the crude rubber, the Thiokol, and the Butyl, and *if* all motorists would engage only in essential driving, and *if* motorists will cut speeds to 40 miles an hour, and *if* they take the best care of their tires—then, and only then, could this or any other plan be adopted." . . .

"The best evidence I have before me shows that there is no rubber of any kind available for anything except the most essential purposes.

"Military and the most essential civilian needs must have first call on all the rubber we have and all the rubber we can get."

Premium Payment Royalties

METALS RESERVE has informed the smelters which are its agents in making over-quota payments that all premium payments for over-quota production of copper, zinc, and lead are to go to the producer except where the producer makes other arrangements. Where royalties are paid directly by the smelter, payment is to be based upon the ceiling price unless specific provision is made for sharing the premium payment in individual instances. The government has avoided the creation of a firm policy on this subject from the beginning, and does not now intend to afford any positive assistance to the producer who may have an embarrassing royalty contract. It is simply hoped that the statement of intent will have some influence in discouraging royalty claims or in effecting a court decision in the operator's favor if his royalty interest resorts to litigation.

Truck Transportation

THE MINING INDUSTRY got some relief when ODT overhauled orders effecting common contract and private carriers in over-the-road and local service late last month. ODT's orders 4 and 5 were supplanted by a new order, ODT No. 17, to govern all over-the-road operations as well as local delivery operations formerly under ODT No. 6. The 75 percent back haul provision has been canceled in the new order, but in place of that objectionable regulation there is a milder restriction. Beginning Sept. 1 contract and private carriers must "in good faith" endeavor to find a load for their trucks prior to departure from any point without a load. This includes registration of trucks at a Joint Information Office and making inquiries of other carriers. As of Aug. 1 the new order has required that trucks "be loaded to capacity over a considerable portion of the trip out or back."

ODT accompanied the revised order with a ray of hope, stating that it is considering a general permit to exempt the movement of certain commodities from some of the provisions of the order—similar to the exemption now enjoyed by carriers moving farm products and supplies. Among the commodities being considered for this action are solid fuels and ores.

Silver Restrictions

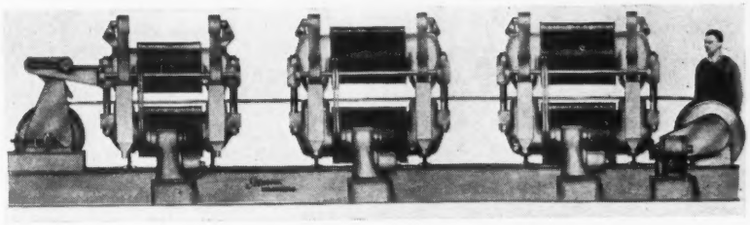
EFFECTIVE OCT. 1, WPB has issued a conservation order, prohibiting the use of imported silver in a number of non-essential uses, such as silverware, jewelry, and musical instruments except with preference ratings of A-3 or higher. Also included in the order are secondary silver and silver produced before July 1, 1939. Until Oct. 1, users are restricted to a rate of consumption not exceeding the average of recent months. The order does not prohibit users from employing newly mined domestic silver if they are able to compete with the Treasury price of 71.11c. per ounce. WPB also put silver ores, bullion, concentrates, coins, compounds, and semi-processed items under import controls. Amendment No. 2 to Order M-63 prohibits, except on WPB authorization, silver purchases for importation and sale, processing or transfer of imported material beyond the place of initial storage without further approval. Government imports are not affected, and existing private contracts are allowed to stand. Private importers may also sell to the government without restriction.

Effective Aug. 10, OPA has established a ceiling price on silver of 35⅜c. per ounce, including charges.

News "Fines"

Strategic Mineral Purchases—Senator Murray announced in July that Metals Reserve had agreed to purchase tungsten and tin ores, mercury, and other strategics in small lots delivered to purchasing depots already established in various parts of the country for manganese and chrome. Except in respect to mercury, his statement was not confirmed by the RFC subsidiary at the time this issue went to press.

EQUIPMENT NEWS



Improved Magnetic Separator

IN THE REDESIGNED TYPE "R" Stearns-Wetherill magnetic separator, recently announced by the Stearns Magnetic Mfg. Co., Milwaukee, Wis., much of the heavy framework used in the earlier models has been eliminated. Both appearance and operating qualities of the machine have been improved, but no sacrifice has been made in strength of the coil-supporting structure.

Using the cross-belt method of separation, the machine has been found applicable to all classes of materials possessing varying degrees of magnetic permeability, and suitable installations can be designed in any desired size. The illustration shows a Type "R" separator consisting of three magnets which yield a total of six products, two from each magnet.

The strength of field at each magnet is controlled by a rheostat, an adjustment which permits close control of operation and the production of clean concentrates. Ammeters in circuit with the windings provide accurate measure of the force used and allow duplication of results.

An extension of magnetic separation methods to secondary-metal recovery has also been designed by Stearns engineers in the form of a combination picking belt and magnetic pulley separator. Suggested for use in reclaiming brass and other secondary metals from assorted metallic refuse, the unit can be adapted to suit a wide variety of purposes. Full information and suggested designs may be obtained from Stearns Magnetic Mfg. Co., Milwaukee, Wis.

Welding Aid

TURCO WELDMASK, a new development of Turco Products, Inc., Los Angeles, Calif., is said to save time in welding operations by preventing spattered molten metal particles from attaching themselves to the area surrounding the weld. Following completion of the job, no grinding is required to clean adjoining metal surfaces and a much neater appearance is secured with little effort. A creamy white liquid, the product is not injurious to the skin and does not affect welding procedure. It may be applied to the work hours before the welding is actually done, and can be removed when desired with a damp rag.

Hydraulic Drilvise

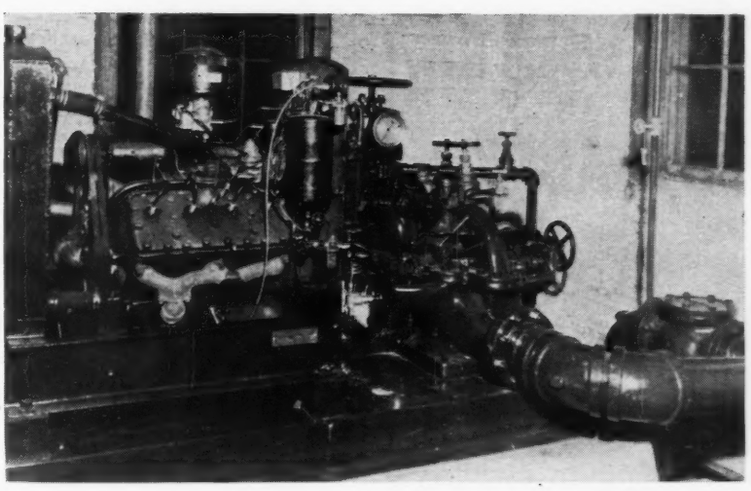
DESIGNED for holding work on the tables of drill presses, planers, milling machines, surface grinders, saws, and other machine-shop apparatus, the Studebaker Hydraulic Drilvise is said to permit greater ease in operating these machines and to insure substantial savings of time in routine operations. The vise consists of one fixed and one movable jaw which is controlled hydraulically by three foot pedals. Both the operator's hands are left free when clamping the work for machining, and any desired pressure up to 10,000 lb. per sq. in. can be secured. Complete details may be obtained from Studebaker Machine Co., 9 S. Clinton St., Chicago, Ill.

Domestic Flints

GRINDING OPERATIONS using amorphous flint pebbles as the medium may now be supplied from domestic sources, according to an announcement of Richard L. Cawood Co., P. O. Box 743, East Liverpool, Ohio. Said to equal the best of the French pebbles formerly used, these domestic flints can be supplied in various sizes and grades. Samples and full information may be obtained from the company.

Variable Speed Transmission

REEVES PULLEY CO., Columbus, Ind., announces a new design of the Reeves variable-speed transmission incorporating a built-in chain reducer and with the output and input shafts in exact alignment. Output speed is infinitely variable within predetermined limits and is controlled by a handwheel. The unit was designed for vertical operation.



Small mining communities may be interested in the Fairbanks-Morse Fire Pumping Unit shown above. Driven by a direct-connected Ford-Mercury engine, the 4-in. No. 5813 fire pump supplies adequate fire protection at moderate cost both for installation and upkeep

Ultra-Violet Lamps

ULTRA-VIOLET PRODUCTS, Inc., 5205 Santa Monica Blvd., Los Angeles, Calif., has announced a new and improved line of Mineralight black-light lamps for use in identifying or prospecting for various fluorescent minerals. Sizes of lamp furnished vary from small portable units to large lamps for permanent installations in ore-sorting plants, and several new features, such as built-in regular flash lights, have been provided. Complete information is contained in a four-color catalog available on request.

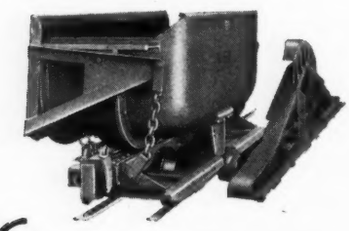
Portable Floodlight

FOR USE IN locations which cannot have installed lighting, such as powder magazines or warehouses containing other combustible materials, General Electric Co. has designed a battery-operated portable floodlight. The unit consists of a 50-candlepower bulb and reflector combination mounted on a steel box, 19x10x21 in., containing a five-cell storage battery with non-spill valves. Powerful medium-angle floodlighting is provided by the unit over a normal burning time of about ten hours.

New G. E. Motors

DESIGNED FOR SAFE OPERATION in dusty locations, a new line of polyphase induction motors has been introduced by General Electric Co. to supply installations exposed to powdered magnesium as used in incendiary bombs or for other military purposes. The motors are totally inclosed, with non-ventilated construction in the smaller ratings and fan-cooled housings for sizes above 2 hp.

A 15-hp. 1,800 r.p.m. motor was subjected to a cloud of fine magnesium dust while running under heating and cooling



A ♣ BULLSEYE!

Card Cars have been shooting at lower haulage costs since 1892 — with a long line of bulleyes to their credit.

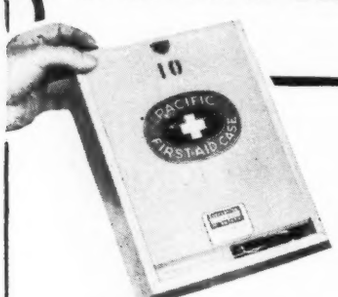
Simplicity in design . . . ruggedness in construction . . . Card Cars crack down on maintenance and repair . . . roll out the pay-dirt at "lowest cost per ton mile haul."

Get Catalog No. 40

♣ A

C.S. Card Iron Works Co.
Denver, Colorado

Here's What's New IN First Aid Kits



Shortages of essential materials started us looking for new First Aid Kit materials...and led us into one of the most practical lines we have ever produced; dustproof and moisture proof in natural finish wood ...as handsome as any we've turned out in our many years of supplying safety to industry.

1B-8

E. D. BULLARD COMPANY
275 Eighth Street
San Francisco, California.

Everything BULLARD on Safety

Send us your new free folder describing the new line of Bullard First Aid Kits that use less critical material and helps keep skilled men on the job.

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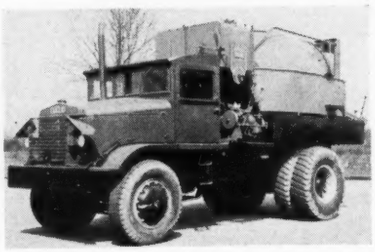
NATIONWIDE SALES AND STOCKS

cycles simulating several years' operation in a series of tests recently run at the Underwriters' Laboratories. Careful examination of the motor after these tests indicated that it had passed them successfully.

The motors are furnished in sizes from 1 to 20 hp. and can be used wherever the presence of combustible dusts presents a hazard classified by the National Electric Code as Class II, Group E.



Cement Mixer Unit

TWENTY 5-cu. yd. Jaeger cement mixers mounted on Euclid Model 14FD chassis and powered by 150-hp. Cummins diesel engines have recently been built for use by Army engineers in constructing military roads, airports, and in other off-the-highway transportation of materials. By removing the mixer unit and making minor structural changes, the chassis can be converted into a standard rear-dump Euclid for hauling earth or rock. This information was furnished by Euclid Road Machinery Co., Cleveland, Ohio.

Automatic Electrical Timer

AUTOMATIC CLOSING or opening of an electric circuit at any predetermined time within 23 hours in advance may be secured by use of an electrical time switch recently developed by Philco Corp., Philadelphia, Pa. The unit has a capacity of 1,200 watts when used on a.-c. circuits, enough to control a 1-hp. motor of the repulsion induction type, and it is easily set up merely by plugging into an outlet and connecting to the apparatus to be controlled.

High-Pressure Flow Meter

MEASUREMENT OF GAS FLOWS at pressures of the order of 5,000 lb. per square inch has been impracticable with mechanical head type meters employing a stuffing box. Cochrane Corp., 17th and Allegheny, Philadelphia, Pa., has developed for high-pressure use a meter which has no float, stuffing box, or high-pressure bearing, being entirely closed and without internal working parts. It is said to offer accuracy, complete safety, and freedom from maintenance costs to plants requiring measurement of hydrogen, ammonia, or other gases at pressures up to 7,500 lb. per square inch.

Standard speed, 25-ton, screw jack recently developed by Templeton, Kenly & Co., Chicago, Ill., is designed for heavy-duty lifting, lowering, and skidding work. It has a full 6-in. lift and weighs 82 lb. complete.

National Emergency Alloy Steels

BECAUSE war production demands huge quantities of high-alloy steels, the supply of the various critical alloying elements is at present inadequate, and a series of lean-alloy steels has been evolved by metallurgists working under the direction of the War Production Board. The new analyses, called NE (National Emergency) steels, contain a minimum of alloying metals in compositions balanced to produce adequate physical properties.

The accompanying table shows the designation of the new steels as well as the old high-alloy metals which they replace.

These NE Steels are now stocked by Joseph T. Ryerson & Son, Inc., and manufacturers can get small lots from any one of the several Ryerson plants for treating and testing in specific applications. Proper selection of steels is thus assured and orders in production quantities may then be placed.

Buyers are requested to report all details of operations in which these steels are used, so that full information concerning them can be compiled and passed on to others. At present only limited heat-treating data are on hand, but Ryerson will furnish all available information with each order.

Carburizing Grade		Medium-hardening Grade		High-hardening Grade	
NE Steels	Replace AISI & SAE	NE Steels	Replace AISI & SAE	NE Steels	Replace AISI & SAE
NE 4023	2300	NE 4042	2330–35	NE 4047	2300
	2500		3130–35		3100
NE 8620	3100	NE 8744	4130–35	NE 8749	3200
	4100		5130–35		4100
	4600		6130–35		4600
	5100				6100
	6100				

INDUSTRIAL NOTES

Navy "E" awards for excellence in the production of war materials were recently presented to the electrical cable works of **American Steel & Wire Co.**, Worcester, Mass., and to the Harrison, N. J. plant of **Worthington Pump Co.** Symbolizing a year of sustained production, a star was added to the "E" flag presented a year ago to **Norris Stamping & Mfg. Co.**, Los Angeles, Calif.

In recognition of payroll allotment subscriptions by over 95 percent of its employees, the Minute Man flag of the Treasury Department was recently awarded to **Foxboro Co.**, Foxboro, Mass., makers of measuring and control instruments.

Wheelco Instrument Co., Chicago, Ill., has established a school at the plant for instructing employees in the uses of Wheelco instruments in various war industries.

Timken Roller Bearing Co., Canton, Ohio, has made the following promotions in its publicity and advertising departments: **Worthing H. Stone** became assistant advertising manager; **S. L. Huffman** was advanced to manager of the news bureau; **Peter C. Poss** was given charge of the publication of technical information by the company.

Southwestern Engineering Co., Los Angeles, Calif., has increased its engineering staff by the appointment of **Dr. A. Tilles** of the University of California, to act as electrical consultant in the construction of the **Manganese Ore Co.** plant near Las Vegas, Nev. **F. C. Blickensderfer,** metallurgical engineer for Southwestern, is at Luning, Nev., to assist in erecting the plant of Basic Magnesium, Inc.

Pittsburgh Lectrodryer Corp., Pittsburgh, Pa., announces the appointment of **J. B. Ambler** as its representative in the middle west with offices at 602 Denver National Bldg., Denver, Colo.

International Minerals & Chemical Corp. announces the election of **James P. Margeson, Jr.**, as vice president in charge of the potash division. **A. Norman Into** has been appointed sales manager. **John T. Burrows** has resigned as vice president of International and will devote his time to **Phosphate Recovery Corp.**, which is owned jointly with **Minerals Separation North American Co.**

J. D. Nicholson has been appointed general manager of **Mine and Smelter Supply Co.**, Denver, Colo. **Oscar H. Johnson** will continue as vice president in charge of manufacturing.

Linde Air Products Co., New York, N. Y., has issued an appeal to all shops and mines to keep oxygen and acetylene cylinders moving as rapidly as possible. Orders should be held to a minimum and empty cylinders should be returned immediately so that all demands for these gases may be supplied.

C. Grannis Bonner, formerly comptroller and, more recently, treasurer of **Brunswick-Balke-Collender Co.**, of Chicago, has been elected treasurer of

THE GREATER CUTTING OR ABRADING *Action* OF THE EAGLE LOG WASHER...

MAY BE EXACTLY WHAT YOU NEED!

In the bigger production job now facing Latin-America, washing ores is an important operation. If you want a cleaner product or if you are planning the installation of new equipment of this type let us give you complete details. We are prepared to make prompt delivery to producers of strategic minerals anywhere.

EAGLE IRON WORKS pioneered the use of spiral screw washers and therefore draws on a wealth of experience which can be applied to specialized applications for EAGLE products. They are in use in all sections of the Western hemisphere. All features of design, construction, and operation have been proven over a manufacturing period of 70 years. EAGLE washers have exclusive features fully protected by patents.

FOR MINE OPERATORS WITH ROADS TO BUILD

The EAGLE log washer has a long and successful record in washing aggregate for sand and gravel production.

A solicitud nos complaceremos en enviar una descripcion detallada de nuestros productos. Si se desea esta descripcion en espanol, nos sera grato suministrarla en ese idioma.

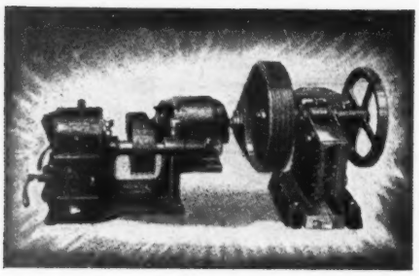
A pedido, teremos todo o prazer em lhes enviar uma descripcao detalhada dos nossos productos. Se assim desejarem, sera em portugues.

EAGLE Products Include:

EAGLE Double Roll Crusher · EAGLE Shale Planer · Olson Self-Dumping Cages · Specialized Mining Equipment · EAGLE Dry and Wet Pans · EAGLE Grinder

EAGLE IRON WORKS
DES MOINES - IOWA

For Speedy Sample Reduction



Chipmunk Crusher and UA Pulverizer with Close-Coupled V-Belt Drive

Efficient, up-to-date equipment is essential in today's busy metallurgical laboratories, where neither time nor labor can be wasted. The Braun UA Pulverizer and Chipmunk Crusher V-Belt assembly is a modern, convenient and compact arrangement of these two indispensable machines which saves space in your laboratory, and saves both time and labor.

This assembly utilizes a close-coupled V-belt drive which eliminates power-wasting, dust-catching, uneconomical overhead shafting, with its attendant mechanical hazards. Efficiently engineered and sturdily built, this speedy sample reduction assembly stands up amazingly under the gruelling day-in and day-out punishment of hard rock crushing and grinding.

Order this modern assembly today to eliminate "bottleneck" conditions in your assay laboratory. Bulletin C-124 gives complete details and prices. Write Dept. E-8 for your copy now.

BRAUN CORPORATION
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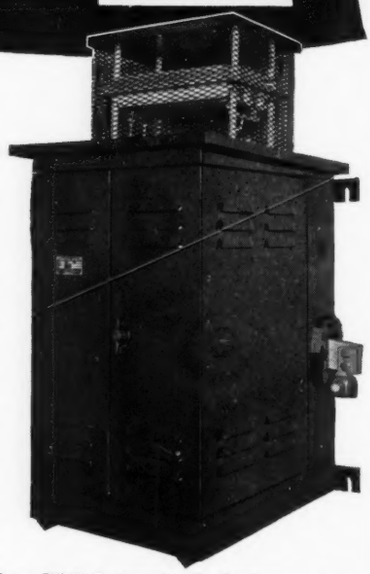
BRAUN-KNECHT-HEIMANN-CO. San Francisco, California
BRAUN
SCIENTIFIC SUPPLIES CO. Seattle, Washington

TO MINE THE MOST

SECTIONALIZING CIRCUIT BREAKERS will add to your war production tonnage



In sectionalizing service, Type KSC circuit breakers help production by providing much better continuity in the operation of mining, loading and haulage equipment. Fire hazards are reduced; maintenance is lessened; total energy consumption and power demand are lowered.

I-T-E is eager to help in any effort to produce more tonnage. Our factory, busy as it is in these days, has capacity for prompt action in meeting the demands of the vital mining industry.

Type KSC Automatic Reclosing Circuit Breaker

Representatives in Principal Mining Areas

I-T-E CIRCUIT BREAKER CO.
PHILADELPHIA, PA.

Pomona Pump Co., Pomona, Calif. He succeeds **Donald C. McKenna**, who will devote full time to production activities.

S. H. Mortensen has been appointed chief electrical engineer of **Allis-Chalmers Mfg. Co.** plants at West Allis, Cincinnati, Boston, and Pittsburgh.

BULLETINS

Electricians' Rubber Gloves. A four-page catalog section, No. 9036, has been issued by B. F. Goodrich Co., Akron, Ohio, describing the Anode process of manufacturing rubber gloves from liquid latex. Also, the seventh in a series of pamphlets dealing with the conservation of rubber products has been released. The latest one describes the care of rubber gloves and is available, together with the previous booklets, on application.

Pump Data Sheets. As a special wartime service to pump operators, Goulds Pumps, Inc., has made available its "Pump Application Sheets", originally prepared for the use of its salesmen. These sheets include both elementary and advanced data on the selection, installation, operation, and maintenance of all types of industrial pumps. They may be had, as well as an 18-page booklet booklet on "Pump Fundamentals," by writing to Department 28, Goulds Pumps, Inc., Seneca Falls, N. Y.

Recording Thermometers. Bristol Company, Waterbury, Conn., has just published Bulletin No. T-302 describing its line of fully compensated, liquid-filled, recording thermometers for temperatures between —125 deg. F and +400 deg. F. Details are given concerning the construction and application of these instruments.

Magnetic Separators. A new 16-page bulletin, No. 81, discussing magnetic separation with particular reference to the mining industry may be obtained from the Stearns Magnetic Mfg. Co., Milwaukee, Wis. The new Stearns-Wetherill Type "R" separator and the other Stearns models are described fully.

Hardinge Ball Mills. Several rebuilt Hardinge ball and pebble mills are now available for immediate delivery at Hardinge Co., Inc., York, Pa. Specifications and prices will be furnished on application, and persons interested are asked to supply details of the prospective installation so that the suitability of the equipment may be judged.

Wear-Resistant Steel. Bulletin No. 117 of Alloy Steel & Metals Co., 1862 E. 55th St., Los Angeles, Calif., outlines the services provided by the company in furnishing abrasion-resistant steel for numerous applications in mines, mills, and construction projects.

Colloidal Graphite. Dispersions of graphite in various carriers for special lubricating purposes are discussed in Bulletin 2308 issued by Acheson Colloids Corp., Port Huron, Mich. Suspensions of graphite are described which are suitable not only for high-temperature lubricants but for impregnating fabrics as well.

Woven Wire Screens. Of interest to all users of screen cloth is a new handbook recently published by Newark Wire Cloth Co., Newark, N. J. Full advice is given on selection, ordering, and testing all manner of screen products, and many tables of useful information are included.

Diaphragm Slurry Pump. Actuated without mechanical linkage, the Oliver diaphragm slurry pump has been a favorite of the mining industry since its introduction. Bulletin No. 307-R of Oliver United Filters, Inc., 33 West 42d St., New York City, N. Y., describes the latest design and recommended hook-ups of this pump.

Rubber Conservation. Prolongation of the life of existing stocks of rubber articles is the object of a new 48-page illustrated booklet published by United States Rubber Co., Rockefeller Center, New York City, N. Y. The book, "First Aid To Industry in Conserving Rubber," is completely indexed and all mechanical rubber goods are included. Users of rubber products who have not already received a copy may have one on application.

Ventube Air Ducts. Extremely well illustrated and thorough in its coverage, the new 44-page booklet on mine ventilation recently published by Du Pont Co. should be of interest to all mine operators. Use of Ventube flexible rubberized ven-

tilating duct is discussed, and separate treatment is given to installations in coal and metal mines and tunnel construction Copies may be obtained by writing Fabrikoid Division, E. I. du Pont de Nemours & Co., Inc., Fairfield, Conn.

Scraper Mucking. Ingersoll-Rand Co., 11 Broadway, New York City, N. Y., has just issued an informative book, "Modern Methods for Scraper Mucking and Loading," containing 184 pages, more than 400 photographs and drawings, and numerous sample problems. It is divided into four parts: scraper hoist equipment; metal mining methods; coal and non-metallic mining methods; and hoists and engineering data. Free copies may be obtained on request to New York or to any of the branch offices of Ingersoll-Rand.

Wood Water Towers. Decision by the WPB to decline priorities for steel to be used in constructing water towers has made necessary the use of wood for this purpose. Timber Engineering Co., Washington, D. C., will furnish free on request, to any recognized engineer, complete designs of water tanks and towers in sizes ranging from 2,000 to 100,000 gallons.

Priorities Explained. Manning, Maxwell & Moore, Inc., Bridgeport, Conn., makers of pressure gauges, safety valves, industrial thermometers, and globe valves, are distributing a booklet entitled "Priorities Mobilize Production for Victory," which explains priorities and how to use them. It is hoped to assist in this way jobbers, salesmen, and customers who have found difficulty in understanding or interpreting the large quantities of WPB orders on this subject.

Diesel-Electric Switch Engine. Bulletin No. GEA-3756 of General Electric Co., Schenectady, N. Y., describes a new 25-ton diesel-electric locomotive which has found wide industrial application, including cement, gravel, and quarrying operations. Furnished in gages from 36-in. to standard, it embodies many features found in railway-type switchers.

Electric Instruments. "Modern Precision," a new 16-page publication of Leed. & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa., contains news of L & N instruments, controls, and heat-treating methods, and their uses in plants and laboratories. The new bulletin supplements the regular catalogs and circulars which will continue to be issued as before.

Metallizing. Building up worn machine parts or defective castings by spraying on corrosion-resistant metal is described in Bulletin 42-A, just published by Metallizing Engineering Co., Inc., Long Island City, N. Y. Examples are given showing how metallized coatings have helped to conserve vital metals and maintain operation in various plants.

Office Construction. Use of Transite movable asbestos wall sections in a rapid construction of offices or other buildings is described in a folder, form TR-29A, obtainable from Johns-Manville, 22 East 40th St., New York, N. Y. Overnight construction of completely finished offices is said to be possible.

Control Instruments. Wheelco Instruments, formerly supplied in aluminum cases, are now available with steel cases at prices shown in Bulletin Z6000, just issued by Wheelco Instruments Co., Chicago, Ill. A wide variety of indicating and recording instruments is described, together with furnace-control units.

Motor Maintenance. Average working time of electric motors has increased from 1,800 to 8,700 hours per year because of war-time demands, new motors are increasingly difficult to obtain, and proper maintenance is therefore more vital than ever. Allis-Chalmers Mfg. Co., Milwaukee, Wis., has published a handbook, "War-time Care of Electric Motors, which presents in fresh and amusing style essential points of maintenance and repair applicable to all makes of electric motors.

Power Circuit Transformers. Copper and conduit may be saved and installations simplified by using small Jefferson Power Circuit Transformers to step down high-voltage current for individual machines or lighting circuits. Bulletin 421-PCT describing these transformers may be obtained from Jefferson Electric Co., Bellwood, Ill.

Steel Pipe. Full information concerning "Shatter-Proof" steel pipe is available from Hill, Hubbell Co., Cleveland, Ohio.

Magnetic Separation. Two recent publications of Stearns Magnetic Mfg. Co., Milwaukee, Wis., describe various phases of magnetic separation. Bulletin 800 explains general aspects of the process, and Bulletin 25-C describes Stearns suspended separation magnets.

THE ATLAS TYPE "A"

Built for main line haulage in metal mines. Comes in 3 and 4 ton sizes for 18 inch track gauge in any desired size for wider gauges. Includes the ATLAS patented double-reduction spur gear drive that gives the best performance of any type of locomotive drive.

THE ATLAS CAR & MFG. CO.
★ **CLEVELAND, OHIO, U. S. A.** ★

PAN-AMERICAN SERVICE

AND EQUIPMENT

for Mill and Placer Operations

ENGINEERING:

Metallurgical Testing and Field Consulting Service on Jigging, Flotation, Cyanidation and Placer Recovery Methods for Dredges and Doodlebugs.

Design of Recovery Plants in Mills and on Dredges; Complete Mill Design.

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Placer and Pulsator Jigs . . . Flotation Machines . . . Reagent Feeders . . . Dewatering Cones and Drags . . . Oil Burners for Industrial Uses and Heating.

Information on the above services and equipment will be gladly sent on request.

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Cables: "Panco"
Design, Metallurgical Testing and Field Consulting Service; Manufacturers of Mill and Placer Recovery Equipment.

On the Industrial Front Throughout the World!

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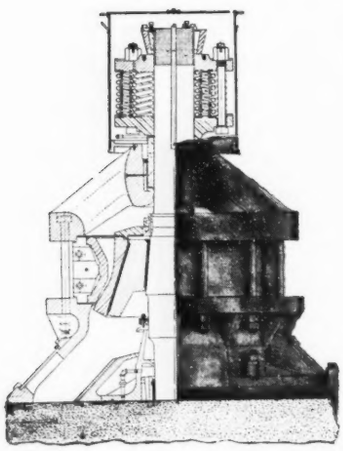

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Refractory and
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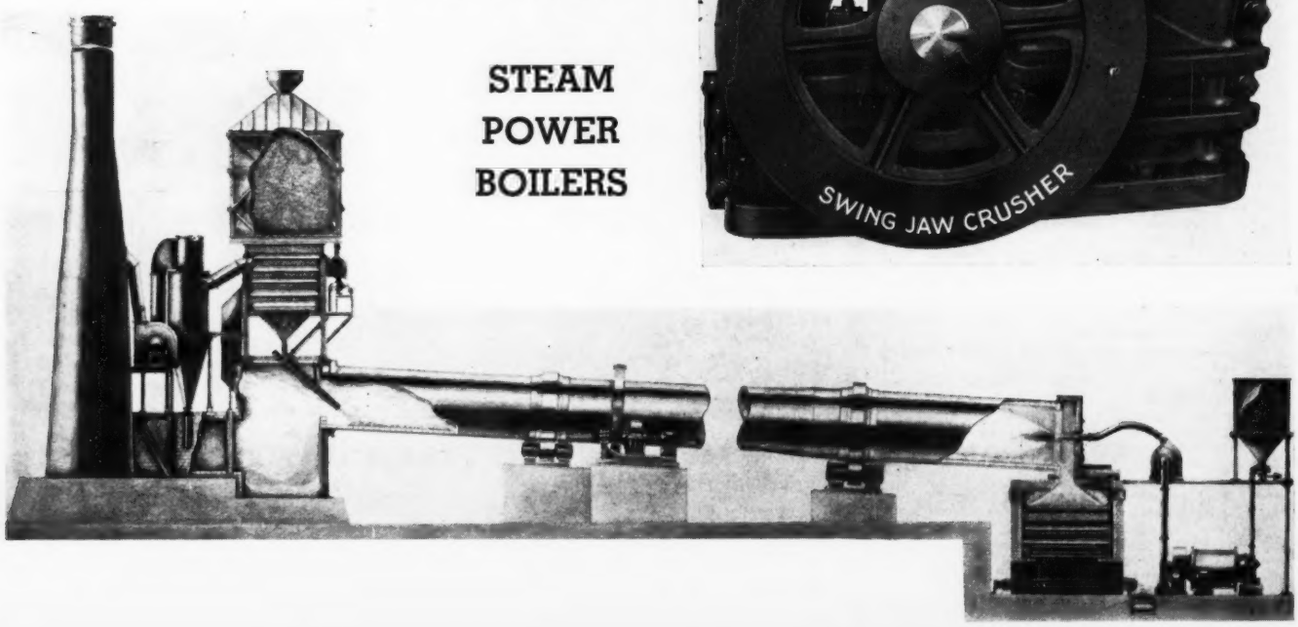

Complete Line of Jaw and Gyratory Crushers, Screens, Elevators, Conveyors, Ball, Rod & Tube Mills, Dryers, Kilns, Coolers, Pulverized Coal Firing System, Steam Boilers, Pneumatic Transport System, Washers, Classifiers, Feeders, Cyclones, Air Filters, Etc.

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